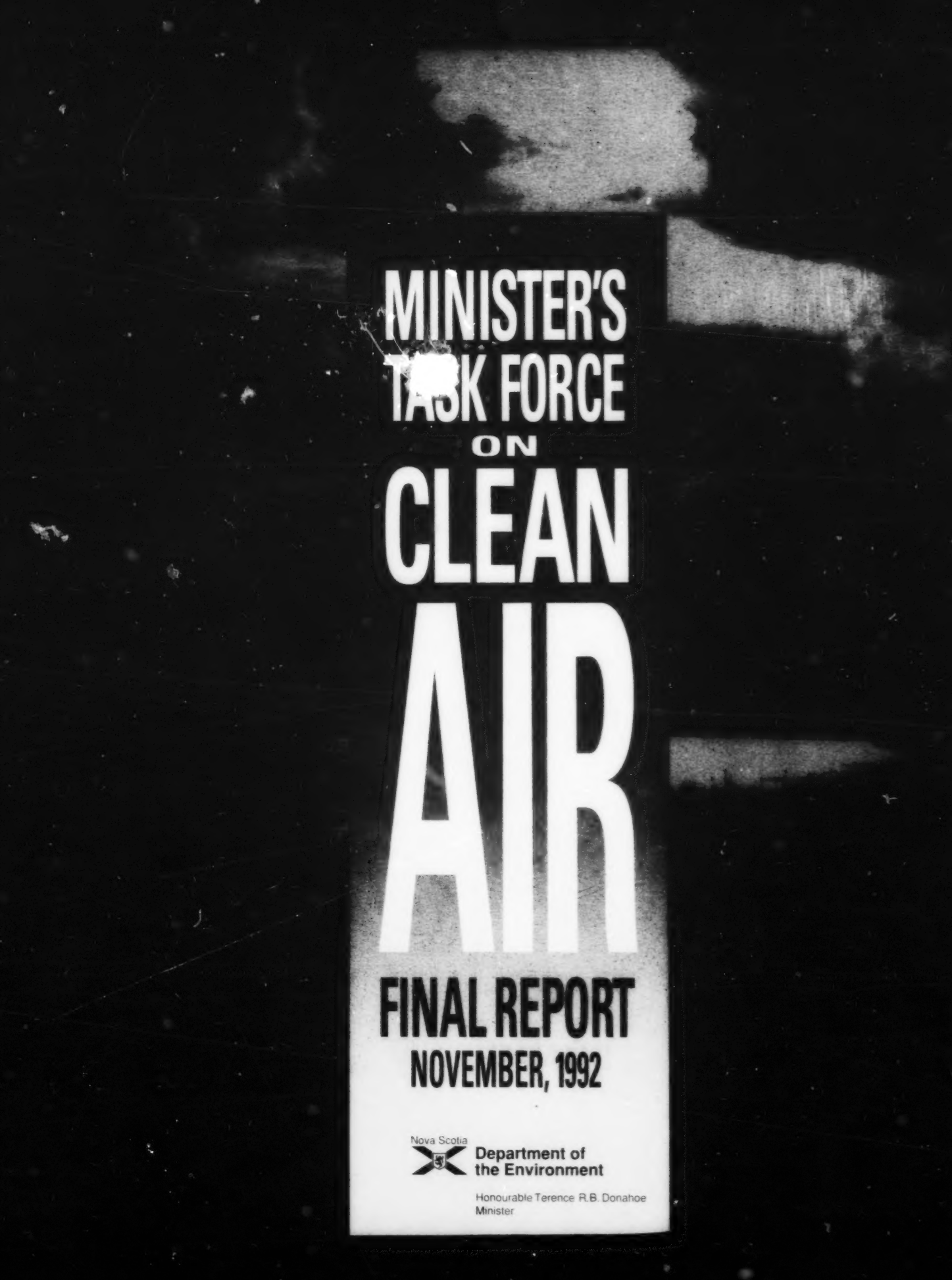

MINISTER'S TASK FORCE ON CLEAN AIR

FINAL REPORT
NOVEMBER, 1992

Nova Scotia
Department of the Environment

Honourable Terence R.B. Donahoe
Minister

93-02108/

ERRATA

- Table 2 on page 4: "Sources" and "Potential Impacts" should be inverted.
- Recommendation #25 on page 30: *Guidelines for the Design and Operation of Municipal Solid Waste Incinerators* should read *Operating and Emission Guidelines for Municipal Solid Waste Incinerators*.
- On page 31, the subheading "Communications" should appear at the top of the right hand column.

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MINISTER'S TASK FORCE ON CLEAN AIR

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Summary

The Minister's Task Force on Clean Air was formed in January 1991 to advise the Nova Scotia Department of the Environment on air quality management. The Task Force heard presentations and received written submissions from more than 100 individuals representing the public, industry, and government and reviewed the air quality management approaches of a number of other jurisdictions.

Air quality in Nova Scotia is affected both by emissions of contaminants from local sources and by imported air pollution originating from sources in the United States and elsewhere in Canada. Air quality data are limited, but suggest that in the main urban and industrial areas of the province concentrations of common air pollutants are still low, with occasional short-term peaks in certain locations. Little is known about the prevalence of toxic contaminants in the atmosphere.

The Task Force established three goals for air quality management:

(1) to work to attain *desirable* levels of ambient air quality (the most stringent level of air quality defined by the National Ambient Air Quality Objectives) throughout Nova Scotia;

(2) to minimize the release of toxic chemicals to the atmosphere; and

(3) to reduce emissions of air contaminants that have impacts of global or regional significance.

To achieve these goals, the Task Force made 70 recommendations, most of which fall into two categories. The first is a comprehensive Air Pollution Prevention Program to be instituted by the Nova Scotia Department of the Environment. The program is directed mainly at industrial sources of air contaminants and involves the development of clear air management policies, legislated air quality and emission standards, improvements to the permitting process and the provincial monitoring network, and the introduction of regional air quality management planning. It is recommended that implementation of the complete Air Pollution Prevention Program be phased in over the next three years.

The second group of recommendations consists of a series of cooperative initiatives involving other provincial departments, other levels of government, the business community, public interest groups, and individuals. These initiatives are aimed at addressing issues of global or regional significance and at reducing air pollution from motor vehicles, homes, office buildings, commercial establishments, and other small, largely unregulated point and non-point sources through education, energy conservation, transportation measures, and support for environmental planning and protection at the municipal level.

Preface

The Minister's Task Force on Clean Air was established in January 1991. Its mandate was to assist the Nova Scotia Department of the Environment in the development of a program to meet Nova Scotia's future air quality needs and to identify the role that governments, industry, and individuals in Nova Scotia can play in protecting and managing air resources at a local, national, and global level.

To help identify existing and emerging air quality issues of public concern, the Task Force invited written submissions from Nova Scotians and held a series of seven public meetings across the province (see Appendix III). Public input has been an invaluable source of information upon which the Task Force has based a number of the recommendations contained in this report. To acknowledge the important contribution that the public has made to the work of the Task Force, an update paper summarizing what Nova Scotians had to say about issues related to air quality and air quality management was released in December 1991. The names of those who made formal presentations, offered written submissions, or joined in open discussions during the public meetings are listed in Appendix IV. In addition to soliciting input from the public, the Task Force heard

presentations from its own members with particular expertise in areas related to air management and met with representatives from Environment Canada and a number of provincial government departments.

This report contains the recommendations of the Minister's Task Force on Clean Air. These recommendations cover a wide range of issues and identify a number of new directions for air quality management in Nova Scotia. In addition, the Task Force has assembled a number of "backgrounders" or briefs providing greater detail on a number of the issues addressed in this report. These backgrounders are listed in Appendix I and will be available upon request.

Table of Contents

Summary & Preface iii

1: Background 1
- What People Told Us 1
- Problems and Sources 2
- Current Air Quality 7
- Current Air Quality Management 11
- Task Force Approach 12

2: Goals 13

3: Recommendations 21
- Air Pollution Prevention Program 21
  - Resources 21
  - Management Approach for Stationary Sources of Air Contaminants 22
  - Permits and Approvals 25
  - Ambient Air Quality Objectives and Regulated Emission Standards 28
  - Monitoring 30
  - Communications 31
- Cooperative Initiatives 32
  - Energy 32
  - Global Warming 34
  - Ozone Layer Depletion 36
  - Transportation 36
  - Health 38
  - Ground-Level Ozone–NOx/VOC Management Plan 38
  - Pesticides 39
  - Municipal Waste Management 39
  - Economic Instruments 40
  - Education 41
  - Municipal Involvement 42
- Implementation 43

Appendix I: Clean Air Task Force Backgrounders 45
References and Further Reading 46

Appendix II: Task Force Members 47

Appendix III: Dates and Locations of Public Meetings 49

Appendix IV: Presenters and Participants 50

List of Tables

Table 1: Common and Toxic Air Pollutants 3

Table 2. Global and Regional Air Pollution Issues 4

Table 3: The National Ambient Air Quality Objectives 9

Table 4: Recommended Policy for the Management of Stationary Sources of Air Contaminants 23

List of Figures

Figure 1: Sources and Emissions of Air Pollutants in Nova Scotia 6

Figure 2: Provincial and National Ambient Air Quality Monitoring Networks 7

Figure 3: Predominant Air Currents in Eastern North America and the Long-Range Transport of Air Pollutants 10

Figure 4: Proposed Time Lines for the Implementation of the Air Pollution Prevention Program 44

1. Background

Many Nova Scotians experience a feeling of relief on returning home from a city such as Toronto, Montreal or New York. The skies over Nova Scotia may not always be blue, but at least they are not yellow or brown. We do enjoy cleaner air here, but we have no cause for complacency. Many of the pollutants generated in the northeastern United States and in southern Canada are swept over Nova Scotia by converging storm tracks; we depend on burning fossil fuels to generate power; and we depend on the private automobile for transportation.

The Minister's Task Force on Clean Air, 11 individuals representing a wide range of interests, met regularly for 16 months and held seven public meetings across the province. Appendix II and Appendix III give details of task force members and public meetings. We also received written submissions and met with representatives from other provincial and federal departments.

What People Told Us

These are the concerns and issues we heard at the public meetings:

- **Health Impacts**. People are worried about the possible health impacts of air pollution. Many believe that there is a general rise in the incidence of respiratory disease.
- **Emissions from Local Industries**. There is concern about the Department of the Environment's ability to regulate and monitor air emissions from industry.
- **Impacts from Power-Generating Plants**. People are concerned about the air quality impacts from existing plants, and both the local and global implications of having to build new plants to meet increasing energy demands.
- **Energy Conservation**. We need to learn to do more with less. Nova Scotia Power is starting to work with demand-side management, but should we not be aiming to reduce our energy use, not just slow its growth?
- **Cumulative Effects**. How can we manage the cumulative effects of air pollutants coming from a wide range of sources large and small, industrial and domestic?
- **Long-Distance Transport**. Acid rain has made Nova Scotians well aware of the potential of pollutants to travel long distances. We also heard about possible impacts of Nova Scotian industry on Prince Edward Island and of New Brunswick industry on Nova Scotia.
- **Monitoring**. Who should be doing it, where, and how often?
- **Transportation**. Both individual consumer decisions and government transportation policies have a major impact on air quality. What is the future for both public transport and a revived rail system in Nova Scotia?
- **Pesticides**. How should pesticide use be controlled to minimize air quality impacts? Better still, how can we wean ourselves from our dependence on chemicals?

- **Waste Management.** Many people are concerned about the impacts of incineration of both municipal wastes and biomedical wastes. Is enough being done to reduce, reuse, and recycle at the front end?
- **Municipal Involvement**. Municipalities are or could be faced with a range of air quality problems and challenges, from dealing with nuisance odours to transportation planning. But often they do not have the powers, resources, or expertise to respond.
- **Zero Pollution**. Some people told the Task Force that Nova Scotia's goal should be "zero pollution," because there is no such thing as a "safe level of pollution." Zero pollution may or may not be attainable, but we should at least be heading in that direction.
- **Environmental Education**. A well informed public makes better individual decisions and influences political decision making. Many people felt that the priority should be to work with students and teachers in the school system.

Problems and Sources

Air pollutants come from a wide variety of sources, both natural and man-made. They can damage health, soils, waterways, crops, forests, and buildings. Their effects may be felt close to their source or thousands of miles away. Some air pollution problems (global warming, ozone layer depletion) are global in their implications. A single pollutant may contribute to more than one problem. For example, nitrogen oxides combine with other chemicals to form the ground-level ozone which contributes to urban smog; nitrogen oxides also contribute to acid rain. Impacts may last a few hours or centuries.

Tables 1 and *2* show some of these relationships between pollutants, sources, impacts, and time scales. Pollutants can be divided into two general categories: common and toxic air pollutants.

Common Air Pollutants. The six so-called "common air pollutants" are sulphur dioxide, nitrogen dioxide, carbon monoxide, suspended particulate matter, ozone, and total reduced sulphur. They may contribute to other air quality problems, but at certain concentrations in the air each can have effects by itself. Routine ambient air quality monitoring usually covers one or more of the common air pollutants (in the Halifax/Dartmouth area the first five are monitored), so we know a little more about the status of these in Nova Scotia relative to other classes of air pollutants.

Toxic Air Pollutants. These include thousands of substances that are potentially dangerous to human health and the environment, even at very low concentrations. These pollutants can be classified into six families: polycyclic aromatic hydrocarbons, volatile organic compounds, dioxins and furans, metals, polychlorinated biphenyls, and pesticides. Standards or regulations exist for a few toxic air pollutants, but in general we know very little about them—their sources, concentrations, and effects.

While the impacts of all common and toxic air pollutants on human health and the environment may be felt close to their sources, many pollutants may also contribute to environmental problems on a regional or global scale. A number of air quality issues with regional or global implications are outlined below.

Acid Precipitation. Acid precipitation, caused by emissions of sulphur dioxide and to a lesser extent nitrogen oxides, was the first "long-distance" air pollution problem to be widely recognized. In fact, most of the acid precipitation that occurs in Nova Scotia is caused by sources as distant as the Ohio Valley, Ontario, Québec, and the eastern United States. Similarly, emissions from local sources, while having some impact on this province, may also contribute to an acid precipitation problem in sensitive areas downwind of Nova Scotia, for example, Newfoundland. Major reductions in emissions of acid gases have already occurred, and more are expected; but the most vulnerable areas in southwest Nova Scotia are not expected to show much improvement.

continued on page 5

TABLE 1: Common and Toxic Air Pollutants

	Common Air Pollutants	Toxic Air Pollutants
Pollutants	Total suspended particulates Sulphur dioxide Nitrogen oxides Carbon monoxide Ozone (See Ground Level Ozone) Total reduced sulphur	Dioxins/furans Heavy metals PAHs PCBs Pesticides VOCs
Sources	**Man-made** • Burning of oil, coal, wood and gas • Automobile emissions • Industrial processes **Natural** • Forest fires • Soil erosion • Natural bogs	**Man-made** • Burning of oil, coal, wood and gas • Waste incineration • Landfills • Industrial processes • Mining • Automobile emissions • Forestry/agricultural sprays **Natural** • Forest fires • Soil erosion
Potential Impacts	Potential health effects including respiratory problems and aggravation of existing health and lung disorders Reduced visibility Soiling Damage to forests and crops	Potential health problems Contamination of water, soils, plants, and food supplies
Duration of Environmental Effects	Days to months	Decades to centuries

TABLE 2: Global and Regional Air Pollution Issues

	Ground Level Ozone		Acid Rain		Global Warming		Ozone Layer Depletion	
Pollutants	**Nitrogen Oxides (NOx)** **Volatile Organic Compounds (VOCs)**		**Sulphur Oxides** **Nitorgen Oxides (NOx)**		**Carbon Dioxide** **Chlorofluorocarbons (CFCs)** **Methane**		**Chlorofluorocarbons (CFCs)** **Bromofluorocarbons (halons)** **Carbon Tetrachloride** **Methyl Chloroform**	
Potential Impacts	**Man-made** VOCs: • Solvent use • Industrial processes • Gasoline distribution NO_x: • Burning of oil, coal wood, and gas • Automobile emissions	**Natural** VOCs: • Forests NO_x: • Forest fires Ozone: • Migration from the stratosphere • Lightning	**Man-made** • Burning of oil, coal, wood and gas • Automobile emissions • Industrial processes	**Natural** • Natural bogs • Forest fires	**Man-made** • Burning of oil, coal, wood & gas • Refrigeration • Air conditioning • Agriculture • Automobile emmissions • Landfills • Coal mines • Foam manufacture and use • Cleaning solvents	**Natural** • Forest fires	**Man-made** • Refrigeration • Air conditioning • Fire extinguishers • Foam, manufacture and use • Cleaning solvents	**Natural** • None for CFCs and halons
Sources	Reduced visibility Respiratory problems Crop damage Forest damage		Acidification of lakes and rivers Damage to buildings and structures Damage to soils, forests and crops		Climate change, resulting in other significant impacts		Skin cancer, eye diseases Crop damage Marine ecosystem damage	
Duration of Environmental Effects	Days to months		Years		Decades to centuries		Decades to centuries	

Ground-Level Ozone. Ground-level ozone, also called urban smog, is a secondary pollutant formed through chemical reactions between nitrogen oxides and volatile organic compounds in the presence of sunlight. In the upper atmosphere ozone serves a vital role in protecting us from ultraviolet radiation. At ground level the same gas can cause serious respiratory problems and affect plant growth. Most ground-level ozone originates in urban areas, but comparatively high levels have been recorded at Kejimkujik National Park, indicating that ozone is largely an imported problem in Nova Scotia. It is possible to track the course of "ozone events" sweeping in, especially from the eastern United States.

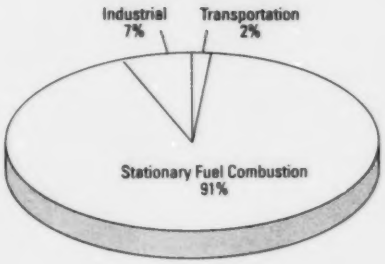
Global Warming. "Greenhouse gases" primarily include carbon dioxide, chlorofluorocarbons, and methane. Emitted in increasing volumes by human activity, they augment the natural "greenhouse" effect of the earth's atmosphere by radiating the earth's heat back to the surface. Carbon dioxide is by far the most ubiquitous greenhouse gas, though not the most powerful in relative terms. Collectively Nova Scotians contribute only a tiny fraction of this global problem, but, viewed on a per capita basis, this amounts to more than our fair share.

Ozone Layer Depletion. Ozone in the stratosphere, between 20 and 50 kilometres above the earth's surface, screens out high intensity ultraviolet radiation. The ozone layer is being depleted by emissions of a number of gases, the best known of which are chlorofluorocarbons (CFCs). Nova Scotia now controls the manufacture, sale, and use of products containing ozone-depleting substances, including fire extinguisers, aerosol sprays, refrigeration and air conditioning units, foam products, and packaging materials.

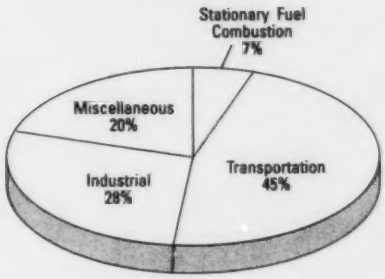
Figure 1 (next page) shows the contribution of different sectors to different air pollution problems. For example, industry is the prime source of suspended particulate emissions in Nova Scotia, stationary fuel combustion (burning coal, oil and wood for heating, power, or electricity) contributes most to sulphur dioxide and carbon dioxide emissions, and transportation is the prime culprit with regards to nitrogen oxides, carbon monoxide, volatile organic compounds, and hydrocarbons.

FIGURE 1: Sources and Emission of Air Pollutants in Nova Scotia

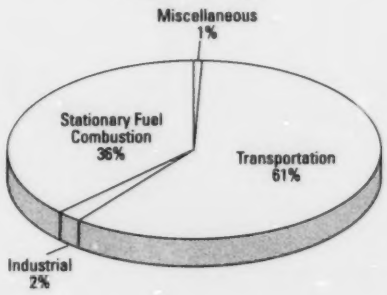
Sulphur Dioxide
(Total: 170,447 t/yr)



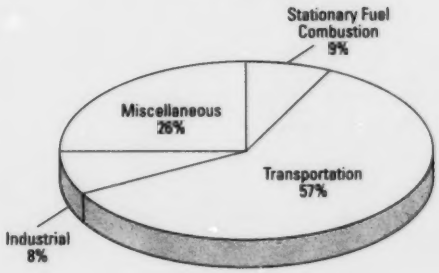
Total Hydrocarbons
(Total: 73,877 t/yr)



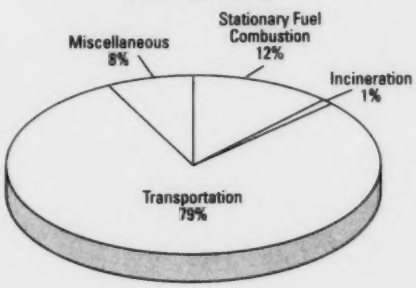
Nitrogen Oxides
(Total: 77,657 t/yr)



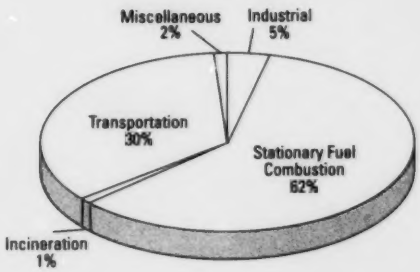
Volatile Organic Compounds
(Total: 53,674 t/yr)



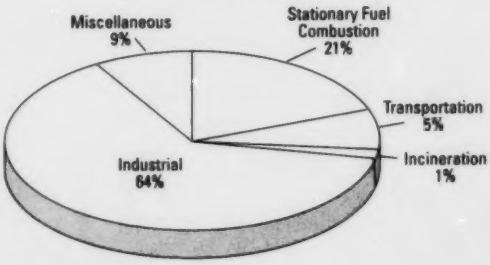
Carbon Monoxide
(Total: 298,756 t/yr)



Carbon Dioxide
(Total: 4,741,408 t/yr)



Total Suspended Particulates
(Total: 72,146 t/yr)



Information presented in all pie charts except Carbon Dioxide is based on 1985 data—source: Kosteltz and Deslauriers 1990

Information presented for Carbon Dioxide is based on 1987 data—source: Jaques 1990

Current Air Quality

The ambient air quality monitoring network in Nova Scotia consists of seven government operated stations. *Figure 2* shows the location of these stations and lists the parameters that are routinely monitored at each station. In addition, Nova Scotia Power operates a number of ambient air quality monitoring stations around several of its power plants.

While the coverage of the existing ambient air quality monitoring network is primarily restricted to the larger industrialized centres, it can be assumed that, for the most part, air quality in rural parts of the province is superior to that in areas with significant local sources of air contaminants. Nevertheless, it will be necessary to establish goals for air quality management and to evaluate the existing monitoring network in the context of these goals if growing public concern for the quality of our air resource is to be properly addressed.

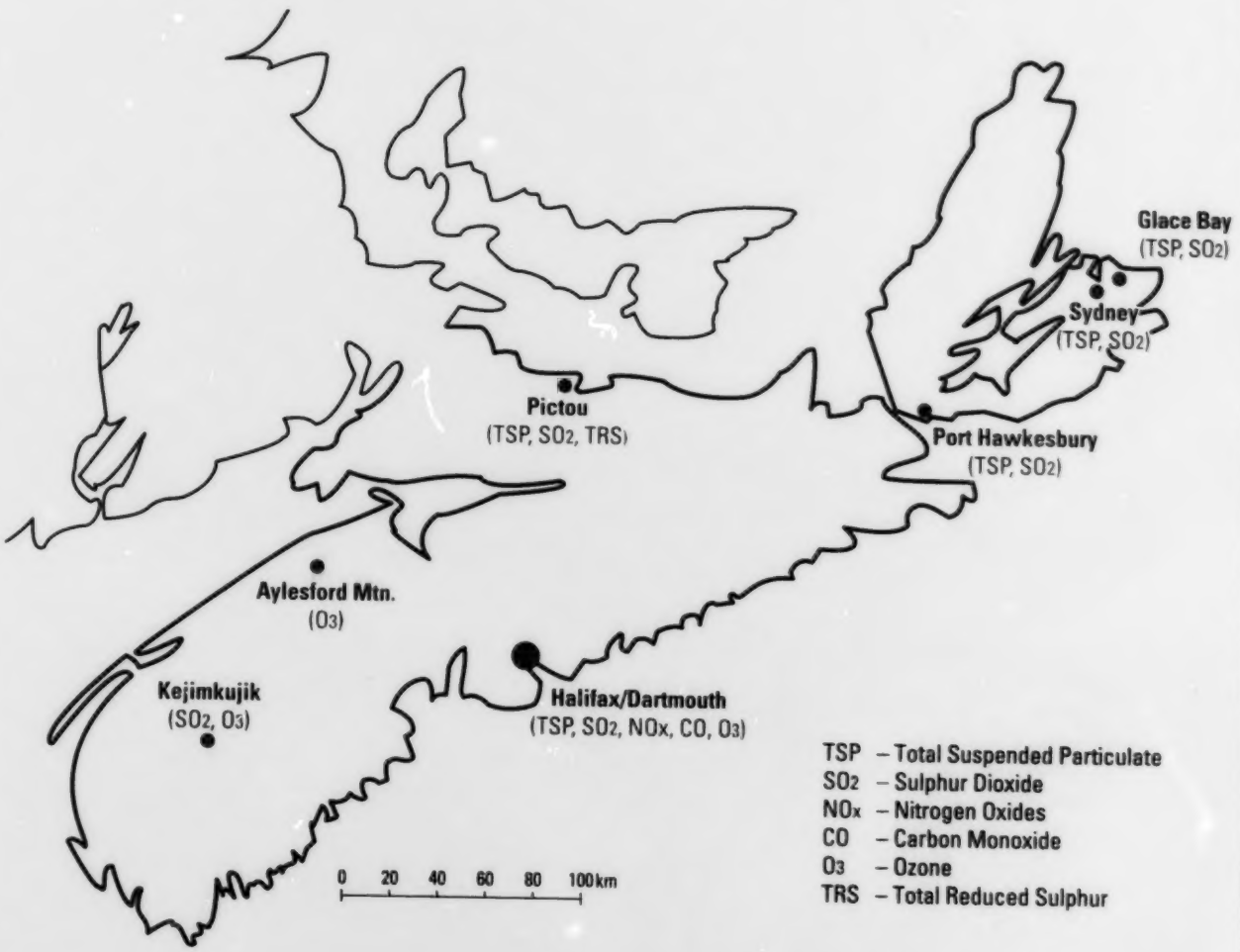


FIGURE 2
Provincial and National Ambient Air Monitoring Networks

Data obtained from ambient monitoring can be measured against the National Ambient Air Quality Objectives, which have been set for the common air pollutants (*see Table 3, on right*). For most of these pollutants, the objectives specify three levels: maximum desirable (most stringent; long-term management goal), maximum acceptable (designed to provide adequate protection for human health and the environment), and maximum tolerable (least stringent; defines the point at which immediate action is required to protect human health and the environment). While the data for Nova Scotia indicate that annual average levels for the common air pollutants are generally within the desirable range, daily or hourly levels have been exceeded in the following areas.

Total Suspended Particulates. At Sydney and Port Hawkesbury there have been occasional exceedances of the 24-hour maximum acceptable level for total suspended particulates (there is no hourly desirable limit for particulates). The monitoring of particulates at Port Hawkesbury was interrupted between 1990 and mid-1992; however, earlier data indicate that the highest 24-hour average levels for total suspended particulates in the province were recorded in this community.

Sulphur Dioxide. Occasionally there have been levels in excess of the one-hour maximum desirable level at Sydney and of the one-hour maximum acceptable level at Port Hawkesbury. Again, the highest hourly sulphur dioxide levels in the province (pre-1990 data) were recorded at Port Hawkesbury.

Ground-Level Ozone. The one-hour maximum acceptable level for ozone has been exceeded occasionally at all locations where it is being monitored. Objectives have been exceeded more frequently at the Kejimkujik monitoring station. In 1988, for example, exceedances of the one-hour maximum acceptable level for ozone were recorded on 11 separate days. Given the remote location of the Kejimkujik station, this illustrates the influence on Nova Scotia's air resource of contaminants transported over considerable distances from sources in the eastern United States and central Canada (*see Figure 3, page 10*).

Total Reduced Sulphur. There have been occasional exceedances of the 24-hour maximum desirable level for total reduced sulphur at Pictou since the fall of 1991 when monitoring was resumed.

Nitrogen Oxides, Carbon Monoxide. Desirable levels were not exceeded for either nitrogen oxides or carbon monoxide at Halifax/Dartmouth in 1991.

It is important to note that there may be other air quality problems that we do not know about, either because there is no monitoring station in the local area or because the problem parameter is not being monitored. For example, there may be localized suspended particulate problems in other parts of the province, and there are indications that total reduced sulphur may be a problem in Port Hawkesbury.

TABLE 3: The National Ambient Air Quality Objectives

Pollutant	Exposure period	Maximum desirable concentration	Maximum acceptable concentration	Maximum tolerable concentration
Total suspended particulates	24-hour	---	120 $\mu g/m^3$	400 $\mu g/m^3$
	one-year	60 $\mu g/m^3$	70 $\mu g/m^3$	---
Sulphur dioxide	one-hour	170 ppb	340 ppb	---
	24-hour	60 ppb	110 ppb	310 ppb
	one-year	10 ppb	20 ppb	---
Carbon monoxide	one-hour	13,000 ppb	30,000 ppb	---
	8-hour	5,000 ppb	13,000 ppb	17,000 ppb
Nitrogen oxides	one-hour	---	210 ppb	530 ppb
	24-hour	---	110 ppb	160 ppb
	one-year	30 ppb	50 ppb	---
Oxidants (ground-level ozone)	one-hour	50 ppb	82 ppb	150 ppb
	24-hour	15 ppb	25 ppb	---
	one-year	---	15 ppb	---
Total reduced sulphur (as hydrogen sulphide)	one-hour	---	10 ppb*	1,000 ppb*
	24-hour	---	3.5 ppb	---

* Proposed objectives

Source for all values except total reduced sulphur: Hilborn and Still 1990.

Source for total reduced sulphur values: Federal/Provincial Advisory Committee on Air Quality 1991.

$\mu g/m^3$ = micrograms per cubic metre
ppb = parts per billion; 1 ppb is analogous to 1 second in 31.69 years

Canada's three-tiered system of air quality objectives

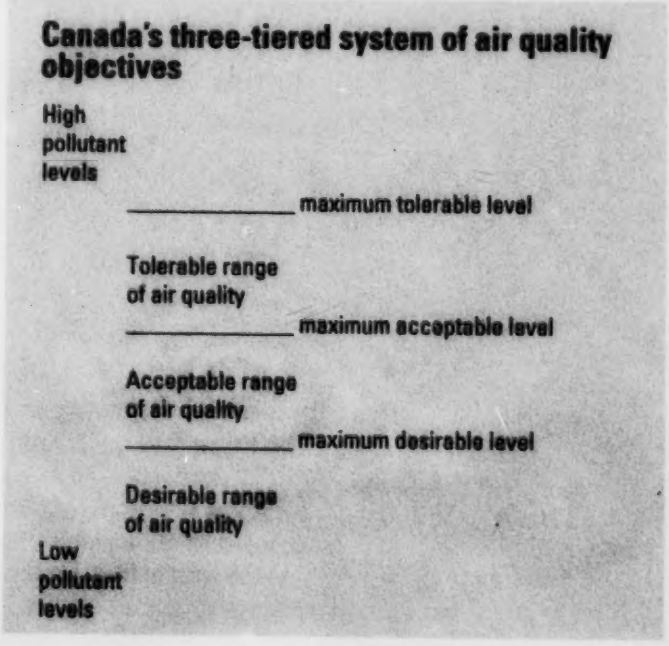


FIGURE 3

Predominant Air Currents in Eastern North America and the Long Range Transport of Air Pollutants

Sixty-five per cent of all sulphur dioxide and 49 per cent of all nitrogen oxides produced in North America are emitted in the dark area to the west of New England (Bormann, 1982).

Current Air Quality Management

Because just about anything anyone does can affect air quality, comprehensive air management would be a daunting task. Very briefly, these were the findings of the Task Force regarding the current state of air quality management in Nova Scotia:

- With the exception of the Department of Natural Resources' current Global Warming Strategy initiatives, other provincial departments generally do not build air quality concerns into their policy and decision making. This is seen to be the role of the Department of the Environment.
- Municipalities are being increasingly faced with issues related to air quality (nuisance problems, transportation, waste management), but their role and authority is undefined and their expertise and resources are limited.
- At present the Department of the Environment could have considerable influence on air quality through its industrial waste permitting program under the *Environmental Protection Act*. The *Environmental Assessment Act* also allows thorough consideration of air-related concerns.
- In the past, however, permits have paid scant attention to air quality, and, in most cases, limited staff resources have ruled out compliance monitoring and enforcement. After the initial permit, most industries have been left alone.
- There are no clear guidelines governing the way air quality concerns should be treated in the permitting process.
- There is a backlog of industries in the province that have never been permitted.
- Ambient air quality objectives are neither included nor referenced in provincial environmental legislation and very few emission standards exist.
- Since the reorganization of the Department of the Environment, staff have been attempting to address many of these problems, but progress is slow because the Air Quality Branch (and other sections of the department) is under-staffed in relation to the provincial, national and international responsibilities they hold.
- The Department of the Environment is constantly struggling to maintain public credibility. Management practices may be improving, but people continue to judge on the basis of past performance. In some cases, it seems as though the department is having difficulty communicating improved practices and new initiatives.
- The provincial ambient air quality monitoring network is not sufficient to keep track of both locally generated and imported air quality problems. There are concerns about the quality of data from the existing stations because of the lack of qualified staff time.
- The management of air toxics will be of increasing concern, especially as new risk assessment work is carried out at the federal level and in the United States. There is a lack of readily available expertise in the area of environmental toxicology in the province (and indeed in the region).
- The Department of the Environment does not appear to have a clear role in either transportation or energy planning in the province. Both of these areas have enormous implications for the environment, and for air quality in particular.

Task Force Approach

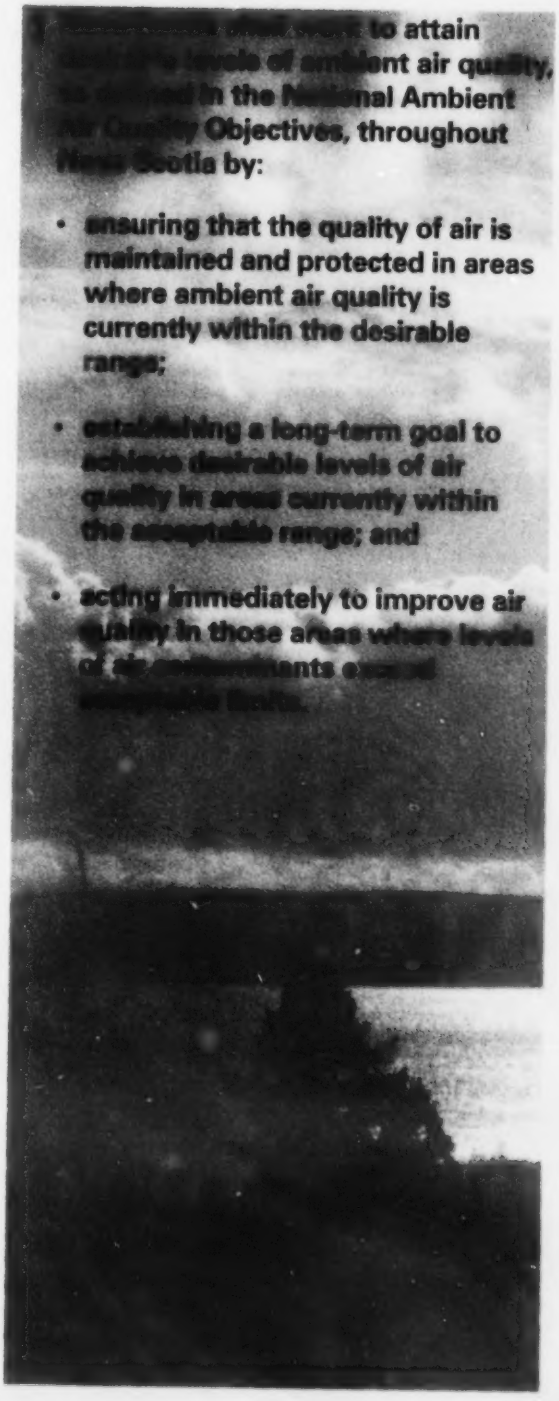
In fulfilling its mandate, the Task Force has assembled a comprehensive suite of 70 recommendations. These recommendations cover a broad spectrum of issues related to air quality and set out new directions for the management of Nova Scotia's air resource. Three central goals provide the foundation for the recommendations.

While the scope of the recommendations is indeed broad, four major thrusts requiring priority attention can be identified. These are:

1. Effective and consistent industrial permitting, to be achieved through the initiation of an air pollution prevention program
2. Energy conservation and planning
3. Transportation planning that integrates environmental costs
4. Municipal empowerment and involvement in environmental management.

Clearly, the first thrust is well within the mandate of the Department of the Environment and, therefore, is readily achievable. The remaining three areas involve the cooperation of other departments and levels of government and the public at large and, therefore, pose greater challenges. Nevertheless, our ability to protect the relatively high quality of our existing air resources as well as to fulfil our international responsibilities will depend on making significant progress in all four areas.

2. Goals



to attain
ont air quality,
in the National Ambient
Objectives, throughout
Nova Scotia by:

- **ensuring that the quality of air is maintained and protected in areas where ambient air quality is currently within the desirable range;**
- **establishing a long-term goal to achieve desirable levels of air quality in areas currently within the acceptable range; and**
- **acting immediately to improve air quality in those areas where levels of air contaminants exceed acceptable limits.**

Rationale

Based on the recommendations of the Federal-Provincial Advisory Committee on Air Quality, the federal government has developed a three-tiered system of national ambient air quality objectives for the common air pollutants (*see Table 3, page 9*).

- The **maximum desirable level** (most stringent) is the long-term goal for air quality and establishes a basis for an "antidegradation" policy for pristine or unpolluted areas.
- The **maximum acceptable level** is intended to provide adequate protection against the effects of an air contaminant on soil, water, living organisms, property, visibility, personal comfort and human health.
- The **maximum tolerable level** denotes the concentration of a contaminant in the ambient air beyond which immediate action is required to protect human health and the environment.

There are a number of important arguments in favour of adopting a goal to strive towards the achievement of desirable levels of air quality throughout Nova Scotia.

- By definition, the maximum desirable levels are intended to represent a long-term management goal and to ensure that the quality of unpolluted air is not permitted to deteriorate.
- Maximum acceptable levels of air quality may not provide the assurance, over the long term, that the health and comfort of more sensitive individuals and the quality of sensitive ecosystems will be adequately protected.
- The perception of Nova Scotia as a clean, even pristine, setting is essential to the promotion of tourism and other economic opportunities. Striving to meet desirable levels of air quality will help preserve this image of Nova Scotia.

Current Situation

While Nova Scotia's air quality is generally regarded as good, it is by no means "pristine." Achieving desirable air quality objectives will require that Nova Scotia take action to reduce levels of TSP, sulphur dioxide and TRS in several areas. Increased monitoring may also be required in some areas, such as Port Hawkesbury.

Reductions in ground-level ozone, on the other hand, will require strong action on the part of the United States to reduce emissions of ozone precursors (nitrogen oxides and volatile organic compounds), particularly in the northeastern states. Given the influence on Nova Scotia's air quality of air pollution originating from sources outside the province (*see Figure 3, page 10*), ambient air quality monitoring aimed at determining the significance of the long range transport of air pollutants (LRTAP) is essential.

There are additional elements of the current approach to air quality management in Nova Scotia that may further impede efforts to maintain and achieve desirable levels of air quality if left unresolved. These are briefly outlined below.

- Achieving and maintaining acceptable levels of ambient air quality represents the principal management target in Nova Scotia at the present time.
- There is currently no antidegradation policy in place in Nova Scotia.
- In the past, the Department of the Environment's industrial waste permitting program has failed to adequately address air quality issues and concerns. As a result, many industries in Nova Scotia are operating under permits that contain very few if any stipulations for air quality control and monitoring.
- While, in recent years, more stringent requirements for air quality control and monitoring have been incorporated into industrial waste permits, a consistent approach for determining these requirements is lacking.
- Permits issued by the Department of the Environment are not directly enforceable.
- The National Ambient Air Quality Objectives and national emission standards have no legislative basis in Nova Scotia.
- For the most part, ambient air quality monitoring in Nova Scotia is restricted to urban and industrialized centres and in some cases, due to resource constraints, the number of monitored parameters is quite limited (*see Figure 2, page 7*). As a result, the department may be limited in its capacity to quantify problems and measure progress towards the achievement of **Goal 1** on a province-wide basis.

Approach

To achieve **Goal 1**, several key steps requiring priority attention have been identified by the Task Force. These steps, which help form the basis of an Air Pollution Prevention Program, include:

- formal adoption of the National Ambient Air Quality Objectives and national emission standards by reference or inclusion in legislation;
- participation in the continued development of national ambient air quality objectives and emission standards;
- evaluation of the ambient air quality monitoring network and the development of a program to implement the necessary changes to the network;
- management, interpretation and reporting of ambient air quality monitoring data in an efficient and effective manner;
- development of policies to define the actions required to address exceedances of ambient air quality objectives and emission standards;
- modifications to the permitting process, including strengthening monitoring requirements for industry; and
- regional air quality management and planning.

Implications

While some of the actions required to achieve **Goal 1** can be accomplished with minimal additional resources, other recommendations will require the Department of the Environment to assume new areas of responsibility, and a simple reallocation of resources will not be sufficient.

Rationale

There are two key reasons why Nova Scotia should begin to address the issue of toxic chemicals in a more comprehensive way.

- First of all, by definition, toxic chemicals have the potential to cause significant harm to human health and the environment, even at very low concentrations.
- Toxic metals and stable, toxic, organic compounds persist and accumulate in the environment. As a result, dilution and dispersal of these contaminants are not appropriate courses of action to control toxic emissions.

Current Situation

The current situation regarding air toxics in Nova Scotia can be summarized as follows.

- There is little in the way of controls for air toxics at present.
- Although there is some federal and provincial legislation respecting the handling, storage, and transportation of toxic materials, ambient air quality objectives and emission standards for toxics are lacking.
- The national Management Plan for Nitrogen Oxides (NOx) and Volatile Organic Compounds (VOCs) contains proposed initiatives that would control the release of some toxic VOCs.
- Under the *Canadian Environmental Protection Act*, national emission standards will ultimately be established for those priority substances determined to be toxic.

Approach

From a management perspective, minimizing the release of toxic chemicals to the atmosphere presents several problems.

- There are literally thousands of toxic chemicals with widely varying chemical compositions, toxicities, and levels of persistence in the environment.
- Toxic chemicals enter the atmosphere from diverse sources, including emissions from industrial and commercial enterprises, motor vehicles, coal furnaces, and wood stoves.
- Monitoring emissions and ambient levels of toxic chemicals is both difficult and costly.
- Currently, there is a lack of information regarding the human health and environmental effects of many toxic chemicals.
- The behaviour of toxic chemicals in the environment is dependent on a complex array of factors and, therefore, is difficult to predict.

Despite these problems, there are a number of approaches that can be taken.

Large-scale Stationary Sources of Toxic Air Contaminants

There are essentially two basic approaches for managing emissions of toxic contaminants from large industrial sources: a risk-based approach and a technology-based approach. Through a risk-based approach, emission limits are determined on a case-by-case basis and designed to minimize the risk of adverse health or environmental effects associated with a given facility. Alternatively, a technology-based approach results in the establishment of minimum emission standards, which are developed for a given industrial sector and can be applied uniformly throughout a jurisdiction.

Because many toxic chemicals are extremely persistent in the environment, building taller stacks to dilute and more widely disperse these contaminants only contributes to their accumulation in other areas, often quite distant from the source. Clearly this is not an appropriate course of action to follow when addressing emissions of toxic chemicals, particularly persistent toxics. However, emission controls determined exclusively on the basis of risk assessment (risk-based approach) do not preclude this option. For this reason many jurisdictions, including Ontario, British Columbia, and the United States, are considering adopting, or have actually begun to adopt, emission standards for toxic chemicals based on available control technology (technology-based approach). Risk assessment will, however, continue to play an important role in ensuring that emission standards based on control technology are sufficient to protect human health and the environment.

In recognizing the need for an approach to limiting emissions of toxic chemicals that is both risk-based and technology-based, the Task Force has recommended adopting emission standards for toxic contaminants that are based on the "best available control technology" (BACT) as a minimum level of control to be applied through the permitting system. However, a risk assessment should be carried out to determine whether more stringent controls are required, or indeed whether a project should proceed.

It is important to note that BACT involves not only "end-of-stack" controls, but can also include process modifications, substitution of toxic materials in the production stream, etc. It is therefore conceivable that BACT could achieve the virtual elimination of certain toxic contaminants from some sources. Wherever possible, this should be the goal for persistent toxic chemicals. In addressing municipal waste incineration, the Task Force has recommended implementing efforts to minimize toxic materials in the waste stream.

Mobile and Small Unregulated Sources of Toxic Air Contaminants

While emissions of toxic air contaminants from large stationary sources can be addressed through the Department of the Environment's industrial waste permitting system, a different approach is required in striving to limit toxic emissions from motor vehicles and small unregulated sources, such as wood stoves, dry cleaning establishments, gasoline filling stations, the burning of domestic wastes in open fires, etc. For mobile and small unregulated sources of toxic air contaminants public education was identified by the Task Force as an essential element in any management approach. To support **Goal 2**, a public education campaign should target:

- the proper maintenance of motor vehicles engines;
- minimum use of household hazardous materials;

- correct use and maintenance of residential wood-burning appliances;
- eliminating the use of coal for home heating;
- eliminating the burning of domestic wastes in wood stoves and open fires; and
- minimizing the amount of all toxic materials entering the waste stream.

Finally, provincial participation in the NOx/VOC Management Plan will help reduce the release of toxic VOCs to the atmosphere. One of the specific initiatives in the plan calls for the reduction of gasoline volatility during the summer months.

Implications

Given our limited understanding of toxic air contaminants and our limited efforts, at present, to regulate or control their release, most of the actions required to achieve **Goal 2** will demand that the Nova Scotia Department of the Environment assume new areas of responsibility. Additional resources and expertise will be needed to:

- evaluate appropriate control technologies;
- evaluate health and environmental risk assessments;
- develop and implement a public education campaign;
- adopt and refine appropriate standards for toxic air pollutants;
- establish methodologies for monitoring toxic air pollutants; and
- improve our understanding of air toxics (Nova Scotia will need to acquire expertise in areas such as environmental toxicology).

Rationale

There are a number of important reasons for adopting **Goal 3**.

- First of all, air contaminants do not adhere to international or interprovincial boundaries. While a significant amount of the contaminants affecting Nova Scotia's air resources originates from sources outside our boundaries, it is difficult to negotiate and demand more stringent controls elsewhere than we are prepared to implement in Nova Scotia.
- Issues that affect the planet as a whole, such as an enhanced greenhouse effect and stratospheric ozone depletion, dictate that Nova Scotians view air quality management in a global context. This implies looking at our contribution to global environmental problems on a per capita basis.
- As a small province, Nova Scotia has an opportunity to lead by example in the area of air quality management.
- In a global economy, allowing Nova Scotia industry to operate with less stringent environmental controls relative to other jurisdictions may adversely affect competitiveness in the long run.

Current Situation

Some of the key programs and initiatives addressing global or regional air quality issues include:

- the Canada/Nova Scotia Acid Rain Reduction Agreement;
- the Montreal Protocol on Ozone Depleting Substances;
- Nova Scotia's *Ozone Layer Protection Act* and supporting regulations;
- the National Action Strategy on Global Warming;
- the Nova Scotia Action Strategy on Global Warming; and
- the Management Plan for Nitrogen Oxides and Volatile Organic Compounds (NOx/VOC Management Plan).

Approach

Energy Conservation and Planning

To stabilize greenhouse gas emissions and to meet the targets for sulphur dioxide emissions set out in the Canada/Nova Scotia Acid Rain Reduction Agreement, energy conservation and planning are essential. In addressing this issue, the Task Force has recommended:

- the development and implementation of a comprehensive energy conservation and management plan;
- giving serious consideration to the energy conservation and alternative energy recommendations contained in the Nova Scotia Sustainable Development Strategy;
- government leadership by example in the area of energy conservation; and
- examining and if necessary modifying the mandate of the Public Utilities Board to ensure that energy conservation is firmly entrenched as a policy direction within a privatized Nova Scotia Power Corporation.

Global Warming

With respect to the issue of global warming, the Task Force has recommended:

- expediting measures to achieve the central goal of the Nova Scotia Action Strategy on Global Warming to stabilize greenhouse gas emissions at 1990 levels by the year 2000;
- ensuring the active involvement of the Nova Scotia Department of the Environment in continued efforts to limit greenhouse gas emissions; and
- ensuring that greenhouse gas emissions are considered in the environmental assessment process.

Ozone Layer Depletion

The Nova Scotia Department of the Environment should ensure that the province's *Ozone Layer Protection Act* and Regulations remain progressive and continue to reflect national and international targets for the reduction of ozone-depleting substances.

Transportation

Given that the transportation sector is a significant contributor to total emissions of NOx and VOCs the Task Force has recommended a number of actions to address emissions from motor vehicles.

Ground-level Ozone and the NOx/VOC Management Plan

Since ambient air quality objectives for ozone are periodically exceeded in Nova Scotia as a result of imported air contaminants, it is in Nova Scotia's best interests to participate in the implementation of the NOx/VOC Management Plan. The Task Force has recommended that Nova Scotia's participation in the Phase I implementation of the plan focus on those initiatives that will have significant impacts on the reduction of ground-level ozone and reduce emissions of pollutants that are significant contributors to other air quality problems (e.g., air toxics, global warming, and acid precipitation).

Acid Precipitation

As noted above, much of the acid precipitation affecting Nova Scotia's lakes and streams is the result of air pollution from sources in central Canada and the eastern United States. However, if we are to expect other jurisdictions to impose stringent controls on emissions contributing to the acid precipitation problem, Nova Scotia must ensure that commitments under the Canada/Nova Scotia Acid Rain Reduction Agreement are met. In addition, Nova Scotia should ensure that any provincial contribution to acid precipitation monitoring produces quality data, which are interpreted and reported in a timely manner.

Implications

The actions required to implement **Goals 1** and **2** are, for the most part, within the jurisdiction of the Department of the Environment. **Goal 3**, however, encompasses a number of broader issues and its achievement will necessitate considerable interdepartmental communication and cooperation.

In addition, measuring progress towards the achievement of **Goal 3** will require enhanced monitoring activities to fully determine the influence of the long-range transport of air contaminants. More complete inventories of domestic sources of air contaminants will also be required.

3. Recommendations

To achieve the goals enunciated in the foregoing section, the Task Force has assembled a suite of 70 recommendations. These recommendations have been divided into three principal categories:

- an **Air Pollution Prevention Program** aimed primarily at controlling the emission of air contaminants from large-scale stationary sources of air contaminants;
- a series of **Cooperative Initiatives** aimed at reducing emissions of air contaminants from the many smaller-scale and often unregulated sources and addressing regional and global air pollution issues; and
- measures designed to guide the **Implementation** of proposed initiatives.

Air Pollution Prevention Program

To address the management and regulation of large-scale stationary sources of air contaminants, the Task Force is proposing the adoption and implementation of an "Air Pollution Prevention Program." This program focuses on those areas that fall directly within the jurisdiction of the Nova Scotia Department of the Environment and encompasses:

- a policy for the management of stationary sources of air contaminants;
- extensive improvements to the industrial waste permitting process;
- the formal adoption and application of ambient air quality objectives and emission standards; and
- additional support for ambient air quality and precipitation monitoring.

However, before the Air Pollution Prevention Program can be effectively implemented, the question of resources must be addressed.

Resources

Many of the recommendations in the Air Pollution Prevention Program will have significant resource implications for the Department of the Environment. However, given our growing awareness of environmental issues, increasing public demand for sound environmental management and regulation, and Nova Scotia's commitment to the principle of sustainable development, a simple reallocation of resources to address environmental issues in a reactive fashion will no longer suffice. The Government of Nova Scotia must pledge greater support and resources for the Department of the Environment if environmental issues are to be adequately addressed in a proactive manner.

1) The Nova Scotia Department of the Environment should increase the number of staff in the Air Quality Branch by at least two person-years in the 1993–94 fiscal year and by at least an additional person-year in the 1994–95 fiscal year.

Management Approach for Stationary Sources of Air Contaminants

The three goals identified by the Task Force require that the Nova Scotia Department of the Environment adopt a proactive approach towards air quality management. This type of approach requires a comprehensive management framework to control both new and existing stationary sources of air contaminants.

Under the current situation, there are major inconsistencies with respect to the controls placed on industries in Nova Scotia for the protection of air quality. Many of the permits held by industries were issued at a time when air quality took a back seat to concerns for water and waste. As a result, many existing industrial permits fail to stipulate specific requirements for air quality control and monitoring. This is in contrast to some of the more recently permitted industries where stringent requirements have been stipulated for air quality control and monitoring.

The Nova Scotia Department of the Environment must work towards placing existing industries on a more comparable footing with new industries coming into the province and ensure that all industries in the province operate according to requirements that are consistent with today's standards for the protection of public health and the environment. This demands a management approach that:

- provides increased and consistent guidance to resource managers within the Nova Scotia Department of the Environment for permitting stationary sources of air contaminants;
- provides proponents of new facilities with "up-front" information on what the provincial requirements are for controlling and monitoring air contaminants so that facilities are properly planned and designed to meet those requirements;
- provides owners and operators of existing facilities with information on what the provincial requirements are for controlling and monitoring air contaminants so that they can develop and implement programs and carry out upgrading to meet those requirements;
- provides a system for controlling emissions of air contaminants on the basis of health and environmental impacts;
- ensures that ambient air quality objectives are met;
- ensures that provincial and national emission targets are being met;
- defines industry's responsibilities for developing and implementing action plans to control exceedances of ambient air quality objectives and emission standards; and
- helps the Nova Scotia Department of the Environment to identify those industries and commercial activities that require permits.

Given these requirements, the Task Force has developed a recommended policy for the management of new and existing, stationary sources of air contaminants (*Table 4, on right*). The proposed policy specifies three levels of control for three distinct categories of air contaminants:

Level I Contaminant. Toxic contaminants (i.e., PAHs, volatile and chlorinated organic compounds, dioxins and furans, heavy metals). Control is aimed at minimizing the release of these contaminants through the application of the Best Available Control Technology (BACT) or equivalent. BACT takes economic factors into consideration and represents the best controls commercially demonstrated in use that can be applied to existing conditions. In some cases, for example with municipal solid waste incinerators, BACT will be represented by existing Canadian Council of Ministers of the Environment (CCME) Guidelines.

For toxic compounds for which evidence exists to show a high health or environmental risk (for example due to known or probable human carcinogenicity and/or persistence or tendency to bioaccumulate in the environment), control should be aimed at virtual elimination. This may require a more stringent level of control referred to as the Lowest Achievable Emission Rate (LAER), which could demand either "leading edge" technological controls or advanced process modifications.

continued on page 24

TABLE 4: Recommended Policy for the Management of Stationary Sources of Air Contaminants

	Level I (persistent toxics)	Level II (common air contaminants)	Level III (nuisance contaminants)
New Sources and Major Modifications	• **BACT** with options for **LAER** (based on assessed risks of health and environmental impacts) • must demonstrate that ambient air quality objectives will be met • baseline monitoring may be required to quantify existing environment • ensure compliance with national and provincial targets (requires emissions inventory and reporting) • must comply with the requirements for existing sources below, following start-up	• **RACT** with options for **BACT** (based on assessed risks of health and environmental impacts) • must demonstrate that ambient air quality objectives will be met • baseline monitoring may be required to quantify existing environment • ensure compliance with national and provincial targets (requires emissions inventory and reporting) • must comply with the requirements for existing sources below, following start up	• **RACT** at a level required to avoid nuisance • must eliminate or minimize impacts • must comply with the requirements for existing sources, following start-up
Existing Sources	• upgrade to meet **BACT** with options for **LAER** in the timeframe consistent with other provinces • develop and implement programs to control exceedances of ambient air quality objectives or national/provincial targets • ongoing air monitoring and reporting to ensure compliance with ambient air quality objectives and process/stack standards	• develop and implement programs to control exceedances of ambient air quality objectives or national/provincial targets (upgrading may be required) • ongoing air monitoring and reporting to ensure compliance with ambient air quality objectives and process/stack standards	• develop and implement programs for control at levels required to avoid nuisance (upgrading may be required) • air monitoring may be required to quantify impacts • may require evaluation and analysis of complaints
Examples	• waste incinerators, coke ovens	• pulp and paper mills, power plants, refineries	• rendering plants, fish processing plants

LAER – The "lowest achievable emission rate" represents the strictest controls required anywhere in the world.

BACT – The "best available control technology" takes economic factors into consideration and represents the best controls commercially demonstrated anywhere in the world.

RACT – The "reasonably available control technology" takes economic factors into consideration, provides for reasonable abatement of emissions and represents the average of the best control technology in use within a given industrial or emission source classification.

Level II Contaminant: Common air pollutants (i.e., sulphur dioxide, nitrogen dioxide, ground-level ozone, carbon monoxide, total reduced sulphur, and total suspended particulates). Control is aimed at compliance with the ambient air quality objectives through the application of Reasonably Available Control Technology (RACT). RACT takes economic factors into consideration, provides for reasonable abatement of emissions, and represents the average of the control technologies in use within a given industrial or emission source classification. The application of Best Available Control Technology for a Level 2 Contaminant would be required only where ambient air quality objectives could not be met with RACT.

Level III Contaminant. Nuisance contaminants (i.e., odours, smoke). Control is aimed at avoiding the nuisance through application of Reasonably Available Control Technology (RACT) that minimizes or eliminates impacts beyond the property boundary of a facility. This requires control to levels well below the onset of any health effects.

Meeting these specific control requirements is only one aspect of the proposed policy. In addition, industries must demonstrate compliance with ambient air quality objectives and national and provincial emission standards.

The application of technology-based controls as minimum standards, with health and environmental risks as the determining factors for the level of control, was chosen for the following reasons:

- it rules out use of the "dilution solution," which comes from building higher stacks and dispersing pollutants over a wider area;
- it supports **Goal 1** in working to achieve desirable air quality;
- it supports **Goal 2** by minimizing the release of air toxics;
- it supports **Goal 3** by requiring a minimum level of emission control where impacts may have more significance outside Nova Scotia's boundaries; and
- it establishes the ground rules for industries coming into Nova Scotia so they know "up front" what the minimum requirements are for controlling emissions.

Under the proposed policy, the most stringent controls are required for Level I contaminants. Given the vast number of these contaminants and our limited understanding of their fate and effects, the task of defining BACT and LAER on a sectoral basis for Level I contaminants will have significant resource implications for the Nova Scotia Department of the Environment. For Level II and Level III contaminants, the proposed policy recommends an approach similar to that already being applied to new sources. However, in many cases, existing sources will have some considerable and potentially costly catching up to do in order to comply with emission limits specified by RACT. Therefore, the Task Force recommends that the Nova Scotia Department of the Environment consult with interested stakeholders to further develop and finalize the proposed policy. The final product should be formally adopted as departmental policy.

Unpermitted, small-scale stationary sources (i.e., commercial and institutional boilers, and dry cleaning operations) and non-point sources (i.e., motor vehicles) are not covered by this proposed management framework. These types of facilities will be most effectively controlled through:

- regulated performance standards that address emissions from these facilities;
- codes of practice that address the design and operation of these facilities; and
- cooperation with municipal governments in developing and enforcing by-laws, and improving land use planning.

2) The Nova Scotia Department of the Environment should adopt the Recommended Policy for the Management of Stationary Sources of Air Contaminants and carry out consultations with interested stakeholder groups to assist in its further clarification and refinement. Following these consultations, the finalized framework should become a policy of the department for application to new and existing stationary sources of air contaminants.

In addition to clarifying terms such as LAER, BACT, and RACT, the consultation process would identify private sector concerns about the proposed policy and help assess its implications.

3) To assist in the development and implementation of the Air Pollution Prevention Program, the Nova Scotia Department of the Environment, in cooperation with local municipalities and industry, should undertake a pilot regional air quality management project in the Strait of Canso area. Such a study should:

- **be built around the three central goals;**
- **consider the combined and cumulative effects of air contaminants;**
- **aim to develop an ambient air quality objectives exceedance protocol; and**
- **strive to delineate relative provincial and municipal responsibilities.**

A pilot-scale regional air quality management project could address many of the air quality issues associated with the current concentration of industry in the Strait of Canso area. The success of such a project would determine the modifications required to implement the proposed management approach on a province-wide basis. There are currently air quality concerns in the Strait of Canso area with respect to sulphur dioxide and total suspended particulates. These issues require immediate attention and should not be left unresolved pending a phased-in implementation of the Air Pollution Prevention Program.

4) To facilitate the initial screening of industrial development proposals and to apprise potential investors of environmental policies and procedures regarding air emissions, the Nova Scotia Department of the Environment should assemble information and materials related to the proposed policy for the management of stationary sources of air contaminants. This information should then be furnished to the Department of Economic Development, potential investors, and economic advisors.

Permits and Approvals

The Task Force identified a number of problem areas within the Nova Scotia Department of the Environment's existing permitting and approvals process.

- As a result of inadequate permitting and enforcement in the past, a number of existing industrial and commercial facilities and activities in the province may not conform to the levels of environmental performance considered acceptable today. This means that the department must endeavour to place all industry on an equal footing by revisiting and revising existing permits that may not adequately address environmental and health concerns. However, at present, the lack of an automated database for permits and approvals renders permit review and revision an onerous task.
- Currently, contravention of a permit does not constitute an offence. As a result, there are no direct means of enforcing compliance with the terms and conditions of the permit. Ministerial orders and the cancellation of permits at present are the only recourse available to the department.
- The current case-by-case permitting approach fails to account for cumulative and combined impacts.
- Procedures for taking action when air quality problems are identified are poorly defined, and the lack of policy or legislative direction makes the permitting process cumbersome and less than consistent.
- Owing to the above problems, there is a lack of public trust in the current permitting process.

It is important to note that, given the increased awareness of the environmental fate and cycling of contaminants in the air, water, soil, and indeed, living tissues, a "cross-media" approach to pollution control, achieved through integrated permitting and standard setting is essential. (A cross-media approach is one that considers the effects of pollution on all components of the environment in a coordinated and integrated manner.) Therefore, in any efforts to address the shortcomings of the current system, the importance of an integrated permitting system must be stressed. Furthermore, a "one-stop shopping" or integrated approach to permitting is supported by business. It is more efficient and cost effective in the long run and encourages comprehensive waste management planning.

To address and help resolve the problems and issues associated with permitting, the Task Force identified several possible regulatory options including :

- using the *Environmental Protection Act* to enable the Minister to formally adopt ambient air quality objectives and emission standards by reference or inclusion in supporting regulations;
- establishing a comprehensive Clean Air Act, which would include ambient air quality objectives and emission standards and define a formalized approach to permitting; and
- combining elements of a Clean Air Act (framework legislation that would give objectives and standards the force of law) and an amended or expanded Environmental Protection Act that would serve to clarify the permitting process.

The Task Force recognized that the most appropriate regulatory course to follow must ultimately be determined by the Department of the Environment with the input and advice of interested stakeholders. As a prerequisite to this decision, the department should establish a consistent approach to grouping and priorizing air quality management problems and air contaminants, so as to provide further policy direction and guidance for resource managers. In addition, clearly defining departmental requirements up front during the registration of the proposed undertaking will serve to simplify and streamline the permitting process.

5) Permits issued by the Nova Scotia Department of the Environment should be directly enforceable and effective deterrents to non-compliance with the terms and conditions of a permit should be provided. In addition, the authority to charge an individual or organization under the summary offence ticket process for any breach of these terms or conditions should be vested in the Department of the Environment.

6) The Nova Scotia Department of the Environment should develop a fully computerized permits and approvals database.

The principal function of a computerized permits and approvals database should be to facilitate efforts to revisit and, where necessary, revise existing permits. However, to restore public confidence in the permitting process, public access to this database should be considered.

7) The Nova Scotia Department of the Environment should identify and define industrial and commercial activities and facilities for which permits should be required. This information should be appended to the industrial waste permit application form. As a first step, criteria should be developed for delineating industrial and commercial sectors based, in part, on environmental and health concerns and the Recommended Policy for the Management of Stationary Sources of Air Contaminants.

Defining those industrial and commercial activities that require permits is an important step towards streamlining the department's permitting process. Appending a list of activities requiring permits to the industrial waste permit application form would provide sufficient regulatory support for such a list while retaining the flexibility to amend the list when necessary.

8) The Nova Scotia Department of the Environment should develop a list of air quality parameters of concern for each industrial and commercial activity or facility requiring a permit, such that quantitative limits or standards can be subsequently affixed to permits.

Once the industries and commercial activities that require permits have been defined and categorized, key parameters of concern with respect to air quality must be identified for each category. This will eliminate much of the work now associated with the development of permit conditions on a case-by-case basis and will provide the groundwork for adopting appropriate ambient air quality objectives, process controls and emission standards.

9) The Nova Scotia Department of the Environment should establish legislative authority to reopen or revisit permits where health and environmental concerns have not been adequately addressed.

In the past, many permits were established in perpetuity. These permits may not reflect the current environmental goals and objectives. Therefore, the Department of the Environment should establish the authority to reopen or revisit any permit when questions or concerns relating to public health, the environment, or quality of life arise.

10) The Nova Scotia Department of the Environment should develop a schedule and priorities for revisiting and revising existing permits, so as to include stipulations related to air quality.

To revisit and, where necessary, to revise existing permits will require considerable time and resources. Therefore priorities and schedules must be established as a prerequisite to such an undertaking.

11) Permits issued by the Nova Scotia Department of the Environment should stipulate conditions for periodic review and/or renewal. Permits should not be issued for periods exceeding five years.

Immediate measures should be taken to stipulate requirements for permit renewal. This will ensure that all permits currently being issued by the Department of the Environment will be periodically re-evaluated.

12) Permit application and registration fees should be increased significantly.

At present, permit application and registration fees are minimal. Substantially increasing these fees could provide much-needed financial support for the department's expanding regulatory and enforcement responsibilities. For example, revenues generated from permit fees could be directed to offsetting the cost of expanding the department's auditing of private sector ambient air quality and emissions monitoring activities (*see recommendation 29, page 30*). To ensure that permit application and registration fees are applied equitably, opportunities for linking fees to projected discharges should be examined. In other words, permit fees could be proportional to the amount or seriousness of contaminants released.

13) Permit application/registration forms and material should clearly reflect the current requirements of the Nova Scotia Department of the Environment.

Increasingly, in today's economic climate investors need to know, up front, what is required of them before they can make sound investment decisions. The Department of the Environment should strive, where possible, to apprise investors of environmental rules, regulations, and requirements as early as possible in the decision-making process.

14) Permit stipulations should clearly specify the point at which an exceedance of an emission standard or ambient air quality objective by an individual source constitutes a contravention of the terms or conditions of a permit.

Efforts should begin ***immediately*** to clearly define, in all permits issued or revised by the Department of the Environment, what constitutes an exceedance of an ambient air quality objective or an emission standard. This will help to determine compliance with the terms and conditions of the permit and will delineate the point at which further efforts to limit emissions and protect human health and the environment are required.

15) Permits issued by the Nova Scotia Department of the Environment should specify a plan of action for addressing exceedances of ambient air quality objectives and emission standards based on a consistent procedural framework.

Efforts should begin ***immediately*** to clearly define, and include in permit stipulations, actions required on the part of a permit holder to address exceedances of ambient air quality objectives and emission standards. Action plans might require industries to reduce production when ambient air quality objectives are exceeded or when atmospheric conditions are such that an exceedance is considered imminent.

16) The Nova Scotia Department of the Environment should establish consistent procedures, through the permitting process, for allocating the provincial sulphur dioxide emission target on an equitable basis.

The current target for total annual emissions of sulphur dioxide from all sources in Nova Scotia is 189 000 tonnes. Of this total, 145 000 tonnes have been apportioned to Nova Scotia Power Incorporated. However, the department has not established procedures for allocating the balance of this emission target to other sources. While the prospects for applying market-based economic instruments, such as emissions trading, should be thoroughly investigated (*see recommendation 61, page 40*), there is also a need to identify and establish procedures for allocating the provincial sulphur dioxide emission target on an equitable basis in the shorter term.

17) The cumulative and combined impact of new industry on ambient air quality should also be accounted for in the environmental assessment and permitting process.

Current efforts to consider the cumulative impacts of new industry in the environmental assessment and permitting processes are important and should be continued and strengthened. Methods and procedures to account for the combined effects of multiple air contaminants need to be investigated and identified.

18) The Nova Scotia Department of the Environment should clearly define the relative responsibilities of the central, regional, and district offices, particularly with respect to permitting. The importance of maintaining a consistent point of contact for an applicant or permit holder must be recognized.

19) Permits issued by the Nova Scotia Department of the Environment should include stipulations for controlling odour emissions with a goal to minimize, and eliminate where possible, potential odour problems.

Odours are one of the most complicated problems in air pollution control today and also one of the most objectionable. Historically, odour problems have not been effectively handled by environmental regulators, and in many cases there has been uncertainty as to whether they were a provincial or municipal responsibility.

In the absence of ambient air quality objectives or emission standards for odour, the Nova Scotia Department of the Environment should ensure that new industrial or commercial facilities take appropriate measures to eliminate odour problems and that existing facilities are required to minimize odour problems. Since odour abatement requires control to levels well below the onset of any health effects, economic factors must also be taken into consideration when determining the level of control. Where odour problems are the result of improper handling and storage of waste materials, the department should consider developing guidelines for the handling and storage of such waste materials (e.g., fish offal).

The control of odours through the permitting process will address only the larger scale stationary sources, which require permits. It will not address odours from the smaller unregulated sources. Effective management of these sources will require involvement at the municipal level (*see recommendation 68, page 42*).

Ambient Air Quality Objectives and Regulated Emission Standards

To support the permit and approvals process in controlling air emissions, there is a need for air quality objectives, emission standards, process control standards, and in some cases, design and operating guidelines. These objectives, standards, and guidelines help to spell out the rules of the permitting process and ensure a consistent and comprehensive approach to controlling air emissions from industry and other activities. However, if they are to be effective in this respect, they must carry the force of law. Therefore, relevant guidelines, objectives, and standards must be included or referenced in regulations.

Given current resource limitations within the Nova Scotia Department of the Environment, and also within many other provincial environment departments, Nova Scotia, other provinces, and the federal government should cooperate to establish acceptable and credible objectives, standards, and guidelines.

An ambient air quality objective defines the concentration of an air contaminant in the atmospheric environment which, if not exceeded, is designed to provide a specified level of protection against the effects of air pollution on soil, water, living organisms, property, and personal comfort and health. A regulated emission standard, on the other hand, defines the maximum level of an air contaminant that can be emitted from a given source. Emission guidelines, which are normally established on the basis of process or stack emission control technology, serve as criteria for developing and adopting regulated emission standards. It is important to note that regulated emission standards are legally enforceable limits.

20) The Nova Scotia Department of the Environment should formally adopt the National Ambient Air Quality Objectives, either by inclusion or reference in legislation.

Ambient air quality objectives provide a frame of reference for monitoring to help ensure that emission guidelines and regulations are sufficient to protect environmental quality. At present, the use of national ambient air quality objectives as a management tool is discretionary. In order to demand and enforce compliance with these objectives, they must be granted the force of law. This should be ***immediately*** undertaken.

21) Through cooperative efforts with other provinces and the federal government, the Nova Scotia Department of the Environment should immediately press for the continued review of existing objectives and the accelerated development of ambient air quality objectives for additional parameters of concern.

When the structure of CCME was revised in 1990–91, the Federal-Provincial Advisory Committee on Air Quality (FPACAQ) and its Air Quality Objectives Sub-Committee were disbanded. This may effectively impede the further development of ambient air quality objectives on a cooperative federal-provincial basis. Objectives have already been established for the common air contaminants, and before the FPACAQ was disbanded the development of objectives for toxic air contaminants was regarded as a priority. Renewed efforts should therefore concentrate on periodically reviewing existing objectives while working towards the establishment of additional objectives for toxic air contaminants, particularly those, such as certain heavy metals, for which a goal of virtual elimination may not be realistically achievable.

22) Through cooperative efforts with other provinces and the federal government, the Nova Scotia Department of the Environment should immediately press for the continued and accelerated development of realistic and applicable emission guidelines. These national guidelines should be formally adopted as regulated standards by the province, either by inclusion or reference in legislation.

National emission guidelines for various emission sources have been developed through the efforts of the Canadian Council of Ministers of the Environment (CCME), for example their *Operating and Emission Guidelines for Municipal Solid Waste Incinerators*. Where these largely technology-based guidelines are applicable to Nova Scotia, they should be adopted as standards.

23) Where national emission guidelines have not been established through federal-provincial cooperative efforts, the Nova Scotia Department of the Environment should review guidelines and standards established in: (a) other Canadian jurisdictions, (b) the United States, and (c) elsewhere to identify appropriate emission requirements for inclusion in permits issued by the department.

For many sources and air contaminants, national emission guidelines have not yet been established. A thorough investigation of guidelines and standards employed in other jurisdictions will assist in identifying and determining appropriate emission levels for air contaminants of concern associated with a given industrial or commercial sector, as proposed in recommendations 7 and 8.

24) The Canadian Council of Ministers of the Environment *Operating and Emission Guidelines for Municipal Solid Waste Incinerators* should be referenced or incorporated directly into Nova Scotia's Municipal Waste Incinerator Regulations as standards. All new and proposed municipal waste incinerators should be required to meet these regulated standards, while existing facilities should be in compliance by 1996.

25) The Canadian Council of Ministers of the Environment *Guidelines for the Design and Operation of Municipal Solid Waste Incinerators* should be referenced or incorporated directly into Nova Scotia's *Biomedical Waste Incinerator Regulations* as standards. All new and proposed biomedical waste incinerators should be required to meet these regulated standards, while existing facilities should be in compliance by 1996.

Monitoring

Monitoring activities are playing an ever-increasing role in the protection of our air resources. In addition to measuring the quality of ambient air and precipitation, the measurement of stack emissions and of process emissions are also becoming important aspects of effective air quality protection programs.

Because air pollution does not adhere to jurisdictional boundaries, ambient air monitoring and precipitation monitoring reflect the impacts of sources both inside and outside of Nova Scotia. For Nova Scotia, air monitoring and precipitation monitoring to determine the influence of the long-range transport of air pollutants (LRTAP) is extremely important since much of Nova Scotia's air pollution originates from sources outside the province. Current control programs being implemented under the amendments to the *Clean Air Act* in the United States are expected to have a significant impact on the quality of air and precipitation in the Atlantic region, especially with respect to acid rain and ground level ozone. It is essential, therefore, that Nova Scotia have a monitoring program in place that will provide some measure of the changes and improvements that result from controls implemented in the United States and elsewhere. This may require the establishment of a coastal monitoring station, removed from the influence of any domestic sources.

When assessing the impacts of activities and operations within Nova Scotia, stack monitoring and process monitoring can be used as direct measures and indicators of air emissions from a specific source. Ambient air monitoring can also be used to establish existing air quality in an area and subsequently to determine the impacts of any new activities or operations in that area.

Given the increasing demand and requirements for monitoring (i.e., ambient, stack, and process), the responsibility for addressing source specific air quality concerns must be shared with the private sector. This will require the Nova Scotia Department of the Environment to carry out auditing activities to ensure that reliable data are being collected and reported. The cost of such an auditing program could be covered by the regulated community through increased permit fees. The Nova Scotia Department of the Environment must ensure that all major emission sources in a given area share in the responsibility for ambient air monitoring to effectively address cumulative impacts.

Nova Scotia must be committed to developing and maintaining effective air quality monitoring (including stack and process) and precipitation monitoring programs. These programs must produce quality data that are interpreted and reported to the public in a concise and timely manner.

26) The Nova Scotia Department of the Environment should immediately evaluate the adequacy of the current ambient air quality and acid precipitation monitoring in the context of the three central goals and develop a program to implement the necessary changes.

27) Permits issued by the Department of the Environment should stipulate the ambient air quality and/or acid precipitation monitoring required to characterize existing environmental conditions and to detect and report exceedances of ambient air quality objectives.

Beginning ***immediately***, the Department of the Environment, in issuing or revising permits, should clearly specify the responsibilities of regulated sources of air contaminants with respect to ambient air quality and acid precipitation monitoring.

28) Permits issued by the Nova Scotia Department of the Environment should require regulated sources of air contaminants to demonstrate compliance with emission standards and to report exceedances. Wherever possible, continuous process control and emissions monitoring should be required.

In issuing and revising permits, the Department of the Environment should ***immediately*** initiate efforts to require regulated sources of air contaminants to demonstrate compliance with emissions standards.

29) The Nova Scotia Department of the Environment should require quality assurance/quality control plans for monitoring activities carried out in accordance with permit stipulations and should develop a program to ensure compliance with these plans.

30) A summary and interpretation of ambient air quality and acid precipitation monitoring data, highlighting any exceedances of ambient air quality objectives, should be reported monthly; and annual summary reports should be made available through regional libraries and offices of the Department of the Environment.

31) The Nova Scotia Department of the Environment should incorporate an air quality index into its monitoring and reporting programs for larger urbanized and industrialized areas.

With the exception of Nova Scotia, Prince Edward Island, and Newfoundland, air quality indexing is currently being carried out in the larger urban centres of all Canadian provinces. An air quality index provides the public with real-time information on the general quality of air in their community. As such, it serves an important educational function. Air quality indices are based on the national ambient air quality objectives and therefore consider both health and environmental effects.

Air quality indexing would require the Nova Scotia Department of the Environment to maintain its commitment to the ambient air quality monitoring network and to produce valid air quality data on an ongoing basis.

The desire for good air quality, as well as other environmental objectives, is shared by a general public that increasingly wants to have its views heard—and not just at election time. It is important to develop forms of public participation that are sensitive to such democratic instincts, and that are often a very important source of self-education. It is incumbent on the Department of the Environment to develop its skills in dealing with and helping the public work through difficult environmental issues.

In addition to improving communications with the public, the Nova Scotia Department of the Environment has a responsibility to keep the business community and other provincial departments apprised of its regulatory requirements. Providing business advisors, both within the Department of Economic Development and elsewhere, with the information and training they need to advise potential investors of environmental regulatory requirements in Nova Scotia is an important first step in communicating with the business community.

32) The Nova Scotia Department of the Environment should review its public communications needs and ensure that training in effective communications, community participation, and public relations is made available to all departmental staff.

33) The Nova Scotia Department of the Environment should review and revise procedures for addressing complaints in a more efficient and consistent manner. Options for better managing complaints, including the use of a computerized database and interoffice reporting mechanism, should be thoroughly explored and implemented.

34) The Nova Scotia Department of the Environment should periodically update other provincial government departments, such as the Department of Economic Development, on environmental regulatory requirements specific to air quality management and provide related training or seminars for business advisors.

Cooperative Initiatives

Through its deliberations, public consultations, and discussions with key individuals from various sectors of government, the Task Force identified and addressed a number of broad issues with potentially significant implications for air quality in Nova Scotia. These issues include fossil fuel-based energy consumption, global warming, transportation, environmental health issues, the emissions of nitrogen oxides and volatile organic compounds, pesticides, and municipal waste management. Wherever possible, the Task Force has endeavoured to focus its recommendations on those activities clearly within the authority of the Department of the Environment. However, many of these broader issues transcend the jurisdiction of any one department. As a result, a number of recommendations are aimed at identifying the need for improved interdepartmental and interjurisdictional cooperation. Since implementation of these recommendations may be dependent on the resources and priorities of a number of departments. Nevertheless, progress towards implementation should be monitored and periodically evaluated.

Energy

The use of fossil fuel-based energy for transportation, heating, the generation of electricity, and the production of goods is a significant source of air pollution on both a regional and a global scale. Thermal electric power generation, particularly coal-fired power plants, emits sulphur dioxide and nitrogen oxides, which contribute to acid precipitation, and carbon dioxide, which contributes to an enhanced greenhouse effect. The principle of sustainable development dictates that the use of energy world-wide must be controlled. Every jurisdiction and every individual has a role to play in this respect. Compelling industrialized nations to limit energy consumption and stabilize or reduce greenhouse gas emissions was one of the key objectives of the Earth Summit held in Rio de Janeiro in June 1992.

The Nova Scotia Energy Strategy released by the Department of Natural Resources in the summer of 1991 proposes limiting the total primary energy demand over the next eight or nine years from a projected 2.3 per cent per year to 1 per cent per year. What is not evident, however, is whether current and proposed energy conservation initiatives will be sufficient to achieve this goal, as they were not necessarily designed to meet this target. In addition, the central goal of the Nova Scotia Action Strategy on Global Warming calls for a stabilization of greenhouse gas emissions at 1990 levels by the year 2000. It is similarly unclear, at this point, how this target will be met. The apparent lack of direction in working towards the attainment of these related goals emphasizes the need for comprehensive energy planning in Nova Scotia.

35) The Province of Nova Scotia should develop and implement a comprehensive energy conservation and management plan. By the end of 1993 the elements of this plan and the steps required for its implementation should be clearly identified. In the development of this plan, priority attention should be given to the recommendations for energy conservation and alternative energy put forward in the Sustainable Development Strategy for Nova Scotia.

The scope of this recommendation extends well beyond the jurisdiction of any one department and is therefore being directed at the provincial government as a whole. There are a number of important recommendations relating to energy planning and conservation contained in the Sustainable Development Strategy for Nova Scotia, released June 1, 1992. From the perspective of the Task Force, those that should be given priority attention are as follows:

- develop power rate structures, including those for households, that encourage conservation;
- encourage the development of seminars and short courses to educate real estate agents on energy efficiency and explore options for indicating the energy efficiency of listed properties;
- ensure that the Nova Scotia Departments of Consumer Affairs and Housing, Municipal Affairs, and Natural Resources promote maximum use of passive solar energy in residential developments;
- encourage the capture of energy from household, municipal, agricultural, and industrial wastes;
- change budgeting procedures for municipal governments and for provincially funded agencies and facilities, such as hospitals, schools, and universities, so capital investment aimed at reducing energy costs through conservation (1) is easy to institute and (2) generates savings that are passed on directly to the implementing institution.

As a corollary to this recommendation, when Nova Scotia's present economy and demographics are taken into consideration, any overall increase in the rate of end-use energy demand should be clearly explained and justified.

36) The Province of Nova Scotia should implement the necessary measures to ensure that the newly privatized Nova Scotia Power Incorporated places appropriate emphasis on demand-side management and energy conservation.

As a private, government-regulated monopoly, Nova Scotia Power Incorporated will gain greater autonomy in determining its own policy direction. However, a privatized power corporation will continue to fall under the regulatory authority of the Public Utilities Board (PUB). Therefore, the mandate of the Public Utilities Board must be examined and if necessary modified to ensure that energy conservation is firmly entrenched as a policy direction within a privatized Nova Scotia Power Incorporated.

37) The Province of Nova Scotia should lead by example in the area of energy conservation and planning.

One of the most effective ways for the provincial government to encourage energy efficiency and conservation is to lead by example. For instance, government should strive to make the most efficient use of energy in all its operations and activities and, wherever possible, demonstrate initiatives undertaken to improve energy efficiency. Similarly, future government and provincially funded facilities should be designed with energy conservation in mind and cost-effective measures should be implemented to maximize energy conservation in existing facilities.

38) The Nova Scotia Departments of the Environment and Natural Resources should identify and discuss approaches for more effectively incorporating environmental considerations into energy planning and define the respective roles and responsibilities of each government department and agency, including the Public Utilities Board, in comprehensive energy management and planning.

As a first step towards implementing this recommendation, the Department of the Environment should review the Nova Scotia Energy Strategy and consult with the Department of Natural Resources on its environmental implications and deficiencies, particularly in terms of demand-side management. In order to encourage other provincial government departments and agencies to assume a role in energy use planning, the establishment of an interdepartmental coordinating committee should be considered.

39) The Nova Scotia Department of the Environment should support initiatives undertaken by the Department of Natural Resources and the Atlantic Wood Energy Technicians Association (AWETA) to offer courses to home owners on the correct use of wood stoves.

For more than 31 per cent of Nova Scotians, wood is either a primary or secondary source of energy for space heating. Wood-burning appliances, when improperly designed, installed, or operated, emit higher concentrations of a number of air contaminants, consume more wood, and deposit greater amounts of creosote in chimneys. These problems are exacerbated with the air-tight wood-burning appliances that gained popularity during the energy crisis of the early 1970s. In some areas of the province, wood smoke can present a significant air quality concern during certain weather conditions.

A 1985 Environment Canada study on the impacts of residential wood burning in Atlantic Canada recommended the development of an education program emphasizing and promoting the correct use and operation of wood-burning appliances. Such a program has already been developed in Ontario and has met with considerable success. The Atlantic Wood Energy Technicians Association has proposed adopting the Ontario program for delivery in communities throughout Nova Scotia. Such a program would increase the level of public education and awareness about the clean, safe, and efficient use of wood-burning appliances. This would result in improved air quality, less fuel usage (reduced tree harvesting), and fewer fire fatalities.

40) The Nova Scotia Department of the Environment should support and encourage the Department of Natural Resources in its efforts to adopt and incorporate into regulations under the proposed Energy Efficiency Appliances Act, the CSA emission standards for wood stoves.

It is expected that the CSA standards prescribing limits for wood-burning appliances will be adopted as regulations under the proposed Energy Efficiency Appliances Act. These regulations will require all wood-burning appliances manufactured, sold, or installed in Nova Scotia to meet these standards. Wood-burning appliances that meet the CSA standards emit lower concentrations of polycyclic aromatic hydrocarbons (PAHs), particulates, and carbon monoxide.

Global Warming

The goal of the Nova Scotia Action Strategy on Global Warming is to stabilize greenhouse gas emissions at 1990 levels by the year 2000. However, 1990 levels are not yet well defined, and the approach to managing greenhouse gas emissions on a provincial scale remains unclear. There is an urgent need to identify how this goal will be met and to develop specific initiatives for the implementation of the action strategy. The achievement of the stabilization goal is inextricably linked to energy efficiency and conservation. This reinforces the need for comprehensive energy management and planning articulated in recommendation 35.

The approach outlined in the action strategy for monitoring progress towards the achievement of the stabilization goal and measuring Nova Scotia's overall contribution to an enhanced greenhouse effect raises a number of scientific questions. First of all, the heat absorption ratios used for intercomparison of greenhouse gases in the action strategy may not accurately reflect the relative contribution of each of the gases to an enhanced greenhouse effect. Secondly, the inclusion of chlorofluorocarbons (CFCs) in the list of greenhouse gases to be addressed by the action strategy

may not be justifiable in the light of current scientific thinking and international consensus.

It should, however, be recognized that the Nova Scotia Action Strategy on Global Warming is the first such provincial strategy adopted in Canada. As such it represents a significant achievement and lays the groundwork for further action.

41) By March 31,1993, a plan of action should be in place that clearly indicates how the central goal of the Nova Scotia Action Strategy on Global Warming to stabilize greenhouse gas emissions at 1990 levels by the year 2000 will be achieved.

If emissions of greenhouse gases in Nova Scotia are to be stabilized at 1990 levels by the year 2000, measures of this goal must be identified and implemented as expeditiously as possible. Since carbon dioxide is the most significant greenhouse gas and the combustion of fossil fuels to produce energy accounts for approximately 97 per cent of total man-made emissions of carbon dioxide, these measures will undoubtedly focus on increased energy efficiency and conservation. Therefore, the identification of initiatives to achieve the stabilization goal should be included as an integral part of energy planning in Nova Scotia and the development of a comprehensive energy conservation and management plan as proposed in recommendation 35.

While the Nova Scotia Action Strategy on Global Warming is a joint initiative of the Nova Scotia Departments of the Environment and Natural Resources, the responsibility for identifying energy-related measures to reduce greenhouse gas emissions will, for the most part, rest with the latter. The Department of the Environment, however, should continue to encourage and support the development of an action plan to achieve the central goal of the action strategy.

42) As the basis for a credit/debit management system for greenhouse gas emissions (as proposed in the Nova Scotia Action Strategy on Global Warming), the Nova Scotia Departments of the Environment and Natural Resources should adopt global warming potentials (GWPs) for specific greenhouse gases, which reflect the best available science and related federal/provincial/territorial discussions on emission limitation strategies. The management system should be flexible and amenable to revisions of the GWPs.

The "heat absorption ratios" used for intercomparison of greenhouse gases in the draft "Nova Scotia Action Strategy on Global Warming—First Phase" (*Table 1, page 3*) are quite different from those commonly used by the Intergovernmental Panel on Climate Change (IPCC) and other groups. The index normally used for such intercomparisons is that of relative "global warming potential" (GWP), which not only considers the instantaneous heat absorption effect associated with a particular gas, but estimates the sustainability of the effects over time, usually for a period of 100 years. At the present time, the GWPs for some gases are uncertain, but as the science improves, they will become better defined. Even so, the GWP is a much more appropriate index than the instantaneous effects, which give no consideration to the sustainability of the effect.

The Canadian Council of Ministers of the Environment (CCME) is in basic agreement that a national strategy to limit net greenhouse gas emissions must be comprehensive and flexible, allowing trade-offs between gases. Such trade-offs require a nationally agreed upon set of GWP values.

43) The decision to include chlorofluorocarbons (CFCs) and ground-level ozone in the list of greenhouse gases included in the Nova Scotia Action Strategy on Global Warming should be reconsidered or re-evaluated.

Internationally (with the exception of the United States), CFCs are not included in global warming strategies, as they are already being dealt with under the Montreal protocol (i.e., no "double counting"). That is also Canada's position. Scientifically, there is evidence that the indirect cooling effect due to ozone depletion by CFCs in the lower stratosphere may offset the warming effect of the CFCs themselves, thus producing a net neutral effect of CFCs on global temperatures. The other fluorocarbons (HCFCs and HFCs), but not CFCs, would be suitable candidates for inclusion in the action strategy.

In addition, scientists generally agree that ground-level ozone and its precursors (NOx, CO, and VOCs) should not be included in the action strategy because the climatic effects of these highly variable

and short-lived gases are very dependent upon both altitude and geography (e.g., much smaller effects near the ground) and thus are not comparable with other greenhouse gases. Furthermore, like CFCs, NOx and VOCs are already dealt with under existing international protocols.

44) The Nova Scotia Department of the Environment should become more actively involved in the decision-making process related to the development and implementation of a Nova Scotia strategy to limit greenhouse gas emissions.

By virtue of its mandate, it is incumbent upon the Department of the Environment to remain actively involved in the continued development and implementation of a strategy to limit emissions of greenhouse gases in Nova Scotia and achieve the stated goal.

45) Emissions of greenhouse gases should be considered in the environmental assessment process.

For projects registered under the *Environmental Assessment Act*, potential greenhouse gas emissions should be assessed in the context of the goal to stabilize the emission of greenhouse gases at 1990 levels by the year 2000.

Ozone Layer Depletion

Ozone in the stratosphere, at heights between 20 and 50 kilometres above the earth's surface, acts as a protective shield against the sun's damaging ultraviolet radiation. Without this "ozone layer," life on earth would not be possible.

In recent years, considerable international attention has focused on observations that the stratospheric ozone layer is being gradually depleted by certain man-made, chlorine- and bromine-containing compounds, including chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform. Most industrialized nations have set targets for phasing out the import and production of CFCs and halons. Recent research, however, suggests that even stricter measures may be required. In response, several countries, including Canada, have accelerated their programs for eliminating the use and production of CFCs and halons.

In February 1991, the Nova Scotia *Ozone Layer Protection Act* and supporting regulations were proclaimed. This legislation deals with ozone-depleting substances in a comprehensive manner and has been described as progressive and thorough. Nevertheless, the extent to which this legislation can be enforced and kept current with evolving national and international initiatives will be the true test of its effectiveness.

46) The Nova Scotia Department of the Environment should ensure that the *Ozone Layer Protection Act* and Regulations continue to reflect national and international targets for the reduction of ozone-depleting substances.

Transportation

The transportation sector accounts for 64 per cent of total petroleum consumption in Canada. As such, transportation represents one of the most significant sources of air contaminants. In Nova Scotia, 61 per cent of nitrogen oxide emissions, 79 per cent of carbon monoxide emissions, 57 per cent of the total emissions of volatile organic compounds, and 45 per cent of total hydrocarbon emissions are directly attributable to the transportation sector. Motor vehicles, particularly the personal automobile, are by far the worst offenders.

While significant improvements in motor vehicle design and fuel formulation have reduced emissions of air contaminants from individual vehicles, the number of cars and trucks on our roads increases every year. Therefore, reducing our dependence on the personal automobile would appear to be the solution. This, however, will require better, more comprehensive community and transportation planning as well as lifestyle changes for most Nova Scotians. In addition, the environmental costs of each mode of transportation must be considered in decisions related to the continuing development of Nova Scotia's transportation infrastructure. These are long-term objectives, which will require considerable interdepartmental cooperation. There are, however, a number of more immediate measures that can be implemented to encourage fuel efficiency and reduce the emissions associated with poorly tuned vehicles.

The Nova Scotia Department of the Environment and the Department of Transportation and

Communications should work together to identify and discuss approaches for more effectively incorporating environmental considerations in transportation planning. Again, some of these considerations include:

- the relative implications for air quality and global environmental concerns of expanding the existing highway infrastructure at the expense of rail transit; and
- the implications for urban air quality of expanding municipal road works at the expense of efficient public transit.

47) In cooperation with the Departments of Municipal Affairs and Transportation and Communications and in consultation with representatives of municipal government, the Nova Scotia Department of the Environment should encourage integrated land use and transportation planning aimed at minimizing transportation-related energy consumption. Particularly in the metropolitan Halifax/Dartmouth area, integrated planning should be initiated to develop a transportation network that will minimize emissions associated with the heavy reliance on personal automobiles.

48) Through interdepartmental communication and cooperation, the Nova Scotia Department of the Environment should ensure that the environmental costs of each mode of transportation are considered in transportation economics and decision making in Nova Scotia.

49) The Nova Scotia Department of the Environment should encourage the Department of Transportation and Communications to augment or enhance the existing motor vehicle inspection program to ensure compliance with emission standards for the operation of motor vehicles.

Poorly tuned engines and the bypassing of emission control equipment account for a very significant portion of the air quality problems associated with motor vehicles. Ensuring proper engine maintenance and the integrity of emission control systems in the most cost-effective means possible should be the primary objective of a motor vehicle emissions control program. Such a program should incorporate an education or public awareness component aimed at reducing emission control system tampering and training for automobile mechanics on the operational maintenance of emission control equipment (Québec has produced an instructional video). Universal annual emission testing could be a very costly undertaking, the results of which could likely be achieved more economically. Instead, an enhanced motor vehicles inspection program should include random "spot checks" to assess emissions from in-use vehicles against federal tailpipe emission standards. The efficacy of such an approach could be evaluated to determine if a more extensive emissions testing program is required.

50) The Nova Scotia Department of the Environment should cooperate with and encourage the Department of Transportation and Communications to strengthen and enforce section 187(2) of the *Motor Vehicles Act*. Authority to take action against obvious polluting vehicles should be provided to peace officers through the summary offence ticket process.

Section 187(2) states that "[the] engine and power mechanism of every motor vehicle shall be so equipped and adjusted as to prevent the escape of excessive fumes or smoke." The definition of excessive fumes should be linked with national tailpipe emission standards and the definition of smoke could be linked to acceptable opacity limits.

51) In cooperation with the Department of Transportation and Communications, the Nova Scotia Department of the Environment should investigate the feasibility of implementing a registration fee or tax differential for automobiles based on fuel consumption.

52) The Nova Scotia Department of the Environment in cooperation with the Department of Transportation and Communications should ensure that emissions fines and fuel consumption taxes are directed toward the establishment of an effective emissions testing and enforcement program rather than to the province's consolidated revenues.

Health

Assessing the impacts of air pollution on public health is a complex and difficult task. The only way to clearly identify the links between air quality and observed health effects is through epidemiological investigations. Such studies, however, are costly and require considerable amounts of time, sufficiently large study populations, and highly specialized professionals. A population the size of Nova Scotia cannot be expected to retain such highly specialized expertise on a continuous basis. However, when significant environmental health issues arise and the tools and expertise to adequately address these issues are not available in Nova Scotia, outside expertise should be consulted. Currently, this does not appear to be the policy in Nova Scotia. The manner in which health concerns related to air quality in Pictou County have been handled may help to illustrate this issue.

In recent years there have been claims of an increased incidence of respiratory ailments amongst residents of Pictou County. These claims have sparked considerable concern and controversy over the possible health effects of emissions (hydrogen sulphide and more complex reduced sulphur compounds, such as mercaptans) from a local kraft pulp mill. Hospital admissions data gathered by a local physician in support of these claims appears less than conclusive, but the Department of Health has limited resources at its disposal to fully assess these data and investigate the claims. As a result, the claims of health problems associated with air quality in Pictou County have neither been confirmed nor refuted, and the issue remains largely unresolved.

Given the cost implications and the limited size of the population in question, a detailed epidemiological investigation is not an option. However, opportunities to apply the results of relevant studies undertaken in other jurisdictions should be thoroughly explored. Where necessary, the Departments of the Environment and Health should draw upon the experience of other jurisdictions or arrange access to the services of a specialist in the field of environmental medicine to resolve environmental health issues in a conclusive and credible manner. As a first step, the Departments of the Environment and Health should coordinate efforts to develop an effective and consistent process for addressing environmental health issues and determining those issues that may require external expertise to resolve. Moreover, a clearly defined route to follow in obtaining information, filing complaints and receiving action regarding environmental health concerns needs to be identified.

53) Where specific public health issues related to air quality arise, the Nova Scotia Departments of the Environment and Health should cooperatively assess their capabilities to adequately address and resolve these issues and to contract or consult outside expertise where necessary.

54) The Nova Scotia Department of the Environment and the Department of Health should coordinate efforts to develop an effective process for resolving issues of public concern related to environmental health.

Ground-Level Ozone–NOx/VOC Management Plan

55) Nova Scotia should continue to participate in the development and implementation of those prevention programs under the NOx/VOC Management Plan that have relevance for Nova Scotia in terms of (1) reducing ground-level ozone and (2) reducing emissions of pollutants that are significant contributors to other air quality problems (i.e. air toxics, greenhouse gases, and acid gases).

Phase I of the CCME NOx/VOC Management Plan to control ground-level ozone in Canada is currently being implemented. The Phase I Plan contains a base set of 31 specific emission reduction initiatives for the national prevention program and is supplemented by a comprehensive set of 27 regional remedial initiatives for those areas of Canada most affected by ground-level ozone. Nova Scotia has not been identified as an ozone problem area, however, occasional exceedances of the one-hour maximum acceptable ambient air quality objective for ozone do occur, mainly as a result of imported pollutants from the eastern seaboard of the United States.

The NOx/VOC Management Plan has significant resource implications for both government and industry. Given the current resource limitations within the Nova Scotia Department of the Environment, participation in the plan should focus

on those initiatives that will have significant impacts either in reducing ground-level ozone or in addressing other air quality problems.

Nova Scotia has already started participating on many of the committees set up to develop prevention initiatives. Some of these initiatives include: New Source Performance Standards for Power Plants, Gas Turbines, Industrial Boilers, and Chemical Plants; Fugitive Emission Controls for Refineries and Chemical Plants; and Vapour Recovery for Gasoline Distribution Networks. In addition to these initiatives, a Motor Vehicle Inspection/Maintenance program was implemented under the *Motor Vehicles Act*, a regulation to control gasoline volatility was introduced, and a vehicle emission testing clinic was held to promote public awareness about the problem of vehicle emissions.

Nova Scotia should continue to participate on committees for the development of source control standards that have relevance for Nova Scotia, in addition to supporting cooperative efforts in the Atlantic Region aimed at improving our understanding of the ground-level ozone problem and specifically quantifying impacts from other regions, such as the United States.

Pesticides

Aerial applications of pesticides in both the agricultural and forestry sectors is a highly regulated activity in Nova Scotia. Permits are required and minimum buffer zones are specified to protect residential areas, watercourses, and other sensitive areas. These restrictions are essential, given the potential for pesticide drift from aerial applications. Pesticides are also applied at ground level in a variety of commercial and agricultural activities, including Christmas tree farming. Establishing minimum buffer zones for ground-level application of pesticides is a very involved and lengthy process. Moreover, given that there are some 3,000 farms and 2,500 commercial Christmas tree growing operations in the province, enforcing minimum buffer zones would be an onerous task. Nevertheless, action is required to ensure that individuals living adjacent to areas that are periodically or regularly treated with pesticides are not exposed to dangerous levels of these products.

56) The Nova Scotia Department of the Environment should cooperate with federal, provincial, and appropriate non-government organizations to determine minimum buffer zones for both aerial and ground applications of pesticides.

57) The Nova Scotia Department of the Environment should continue in its efforts to require every individual applying pesticides for commercial or agricultural purposes to obtain a licence. Recommended minimum buffer zones for ground application of pesticides should be incorporated into the training component of the licensing program.

58) The Nova Scotia Department of the Environment should continue to actively participate in federal-provincial and interdepartmental initiatives to encourage alternatives to pesticides and minimize pesticide usage.

Unlike certain other provinces, Nova Scotia has not set targets for the reduction of pesticides. British Columbia, for example, has proposed a 25 per cent reduction in pesticide use by 2005. While the current mandate of the Pesticide Management Branch of the Nova Scotia Department of the Environment does not specifically encompass pesticide-use reduction, the promotion of integrated pest management (IPM), alternatives to pesticides, and minimum use of pest control products is not precluded. In fact, the Pesticide Management Branch of the Department of the Environment, the Nova Scotia Agricultural College, and several other groups and institutions in the province are actively involved in promoting IPM and researching alternatives to pesticides.

Municipal Waste Management

In Nova Scotia financial assistance for regional solid waste management projects is contingent upon submission of an acceptable "comprehensive solid waste management plan." Such a plan must include a thorough examination of options for recycling, resource recovery, and household hazardous waste management. The environmental costs and benefits associated with a solid waste management facility must also be identified in the plan.

Incineration is one option that may be considered in comprehensive waste management and one that bears significance for air quality management. For existing facilities and where incineration has been identified as an appropriate option for municipal solid waste disposal, it is essential to minimize the volume of toxic materials entering the waste stream.

Waste minimization achieved through resource recovery and recycling is an important component of comprehensive waste management planning. Operators of waste disposal facilities, including incinerators, are now required to meet specific targets for waste reduction and recycling (10 per cent by 1994 and 25 per cent by 1996 with an opportunity for 70 per cent participation in recycling programs). These targets are based on an estimated 850 000 tonnes of municipal solid waste per year, province-wide.

59) The Nova Scotia Department of the Environment should continue to encourage and further ensure that waste minimization and recycling are considered priorities in municipal waste management planning such that the need for municipal solid waste incineration is minimized.

60) In order to facilitate the removal of toxics from the waste stream, the Nova Scotia Department of the Environment in cooperation with the municipalities should:

- **develop effective programs for reducing and recovering household hazardous wastes;**
- **institute a battery recovery program; and**
- **investigate opportunities for minimizing the incidence of plastics in the waste stream through container legislation, deposit systems, and increased support for recycling.**

Economic Instruments

While stricter regulations and a more consistent and comprehensive permitting process may be essential to an improved air quality management framework, the traditional "command and control" approach is not without its limitations. The effective implementation and enforcement of regulations on a case-by-case basis can be a costly proposition and questions of equitability in the application of the regulations may also arise. Market-based controls and other economic instruments offer an alternative to the exclusive reliance on regulatory tools. A market-based approach essentially provides a basis for quantifying the social and environmental costs of pollution and for incorporating these costs into economic decision-making processes. Emissions trading is probably the most frequently cited example of a market-based control.

Simply stated, emissions trading involves defining maximum contaminant loadings for a given area and apportioning these maximum loadings amongst contributing sources. The value of each unit of a defined loading is determined by market pressures and reflects the least-cost, or most economically efficient control scenario for the given area. These units or emission credits can then be purchased, sold, or traded between competing sources. The success of this kind of approach to pollution control is largely dependent on the number of sources operating in a given market. In Nova Scotia, it is doubtful that the level of industrialization would support effective emissions trading. However, the opportunities for implementing such an approach on a larger scale (e.g., the Atlantic provinces) should be more thoroughly investigated. In addition, there are other non-market economic instruments, such as pollution charges and accelerated depreciation of pollution control equipment. Although non-market economic instruments may be more applicable on a provincial scale, the implementation of carbon taxes, for example, might require interjurisdictional coordination at the national level to avoid the possibility of disadvantaging industry in one province relative to another.

61) Under the Atlantic Accord on Environmental Cooperation the Nova Scotia Department of the Environment in conjunction with other Atlantic Region provinces should investigate regional emissions trading as a long-term option for allocating provincial sulphur dioxide and other future emission targets.

The current target for total annual sulphur dioxide emissions in Nova Scotia is 189 000 tonnes. Of this total, 145 000 tonnes has been allocated to Nova Scotia Power Incorporated. However, there is currently no established formula for allocating the remainder. Through the Atlantic Environmental Accord, emissions trading on a regional scale may

provide an option over the long term. However, as reflected in recommendation 16, there is a need in the shorter term to establish consistent procedures for allocating the provincial sulphur dioxide emission target on an equitable basis.

62) In cooperation with other departments and jurisdictions and in consultation with industry and other interest groups, the Nova Scotia Department of the Environment should explore and assess the viability of the market-based approach to air quality management. The application of other economic instruments, including accelerated depreciation, soft loans, and pollution charges, should also be thoroughly investigated.

Education

One of the most important tools available to the provincial government to address air quality management and interrelated environmental issues is education. This is true whether the province relies on a command and control system of regulations, market-based incentives, or some combination in order to ensure the achievement of air quality goals and objectives in Nova Scotia. In order to be successful, any approach to implementing clean air policies requires the understanding and support of the public, since most of these policy instruments are intended to change the behaviour of firms, organizations, and individual citizens.

There are at least three important dimensions to environmental education. First, it should be directed towards developing basic school curricula that incorporate both science programs, which provide the intellectual underpinning necessary for students to understand our environment, and issue-oriented environmental study. It is also crucial that environmental subject matter is integrated into teacher training programs so that new teachers are prepared to deal with environmental subject matter.

Second, a wide range of professionals currently in the work force need to be provided opportunities for environmental continuing education or, in some cases, further university credit education. This is needed to upgrade environmental literacy among professionals, such as public and private sector decision makers and managers, project engineers, developers, teachers, union leaders, and community organizers, and to provide new skills for environmental action relevant to their areas of interest and expertise. In promoting environmental continuing education, it is vital that the Government of Nova Scotia lead by example, by developing innovative programs to educate senior provincial decision makers about the environment. Just such an approach has been developed by the Canadian Centre for Management Development to provide senior federal civil servants with some background in environmental issues of relevance to their particular areas of responsibility. This program could provide a model for decision makers at the provincial and municipal levels as well.

Third, there is a need to educate the general public about environmental issues and the action they can take to contribute to a healthy environment. This is especially important in dealing with environmental problems such as open burning of domestic wastes, the use of residential wood stoves and coal furnaces, and the use of more fuel-efficient and environmentally friendly motor vehicles. There are many educational means that can be employed: for example, environmental awards, media campaigns and educational programs, promotion of better environmental journalism, and calling attention to environmental trend setters. Again all levels of government in Nova Scotia should strive to be counted among the most enlightened environmentalists so that they educate by example.

In February 1992 the Nova Scotia Round Table on Environment and Economy's Subcommittee on Environmental and Sustainable Development Education released its draft report containing a comprehensive suite of recommendations to enhance environmental education in Nova Scotia. The importance of education in addressing and resolving air quality and other environmental issues cannot be over-stressed. The recommendations contained in the Subcommittee report should be given full consideration.

63) The Nova Scotia Departments of the Environment and Education, the Nova Scotia Teachers Union, the Nova Scotia School Boards Association, and the various schools of education in the province should cooperate to ensure that public school curricula and teacher training include and adequately address environmental issues, including those related to air quality.

64) The Nova Scotia Department of the Environment should assure that environmental education programs for business leaders, senior provincial decision makers, and municipal development officers are developed. Such programs should be periodically updated and delivered at regular intervals.

65) The Nova Scotia Department of the Environment, in cooperation with environmental, community, and business organizations, should develop and formalize a program to inform and educate the general public about air quality and other environmental issues and about actions that every individual can take to ensure a healthy environment. A public education program to address air quality issues should specifically target:

- **the proper maintenance of motor vehicle engines;**
- **minimum use of household hazardous materials;**
- **correct use and maintenance of residential wood-burning appliances;**
- **eliminating the use of coal for home heating;**
- **eliminating the burning of domestic wastes in wood stoves and open fires; and**
- **minimizing the amount of toxic materials entering the waste stream.**

Municipal Involvement

To effectively address air quality issues associated with small-scale local sources of air contaminants, municipal involvement is critical. While municipalities have little authority to regulate emissions directly, land use planning, which is essentially a municipal responsibility, can be effectively used to prevent small-scale commercial and industrial enterprises from locating in or near residential areas where emissions may represent a source of nuisance or affect quality of life. In addition, with the assistance of the Departments of the Environment and Municipal Affairs, municipalities could enact by-laws limiting or prohibiting the use of wood-burning appliances under certain conditions or circumstances.

66) The Nova Scotia Department of the Environment, the Department of Municipal Affairs, the Union of Nova Scotia Municipalities (UNSM), and other municipal representatives should cooperatively develop a strategy to define and support environmental initiatives, planning, and regulation at the municipal level.

As a first step towards implementing this goal, the Department of the Environment should organize a conference with representatives from municipalities, the Department of Municipal Affairs, and the UNSM to define opportunities for supporting environmental initiatives at the municipal level.

67) The Nova Scotia Departments of the Environment and Municipal Affairs should cooperatively develop guidelines to assist municipalities in drafting by-laws restricting or controlling emissions of air contaminants from small-scale, unregulated sources.

68) In consultation with the Union of Nova Scotia Municipalities and the Department of Municipal Affairs, the Nova Scotia Department of the Environment should encourage and assist one or more municipalities in developing an action plan to maintain and improve ambient air quality by addressing, in particular, such issues as:

- **unregulated commercial sources of air contaminants;**
- **residential wood-burning appliance and coal furnaces;**
- **transportation; and**
- **odours.**

Implementation

In developing a detailed program and schedules for the implementation of the recommendations contained in this report, the Task Force recognizes that the Department of the Environment will need to fully assess the resource implications associated with each of these recommendations. However, the Task Force urges the department to begin work in all areas within three years; and the four key areas alluded to in the background, namely the Air Pollution Prevention Program, Energy Conservation and Management, Transportation and Municipal Involvement, should be accorded priority attention. Proposed timelines for implementing the component elements of the Air Pollution Prevention Program are presented in *Figure 4*, next page.

The Task Force recommends that progress on the implementation of the recommendations be reviewed on an annual basis by an independent advisory body. The establishment of a separate board for this purpose would be costly, cumbersome, and unnecessary. An air quality subcommittee of the Nova Scotia Round Table on Environment and Economy, for example, could be established, or alternatively, opportunities may exist for Task Force representation on an existing subcommittee.

69) Progress on the implementation of the recommendations contained in this report should be reviewed annually by an independent advisory body.

70) The Nova Scotia Department of the Environment should develop a plan and schedules for the implementation of the recommendations assembled in this report. The implementation plan and accompanying schedules should be subject to review by the advisory body, and any departure from the time frames proposed in this report should be justified.

FIGURE 4: Proposed Time Lines for the Implementation of the Air Pollution Prevention Program

Component I

Policy for the Management of Stationary Sources of Air Pollution

- Stakeholder consultation
- Establish procedures for determining control technologies
- Policy refinement and implementation

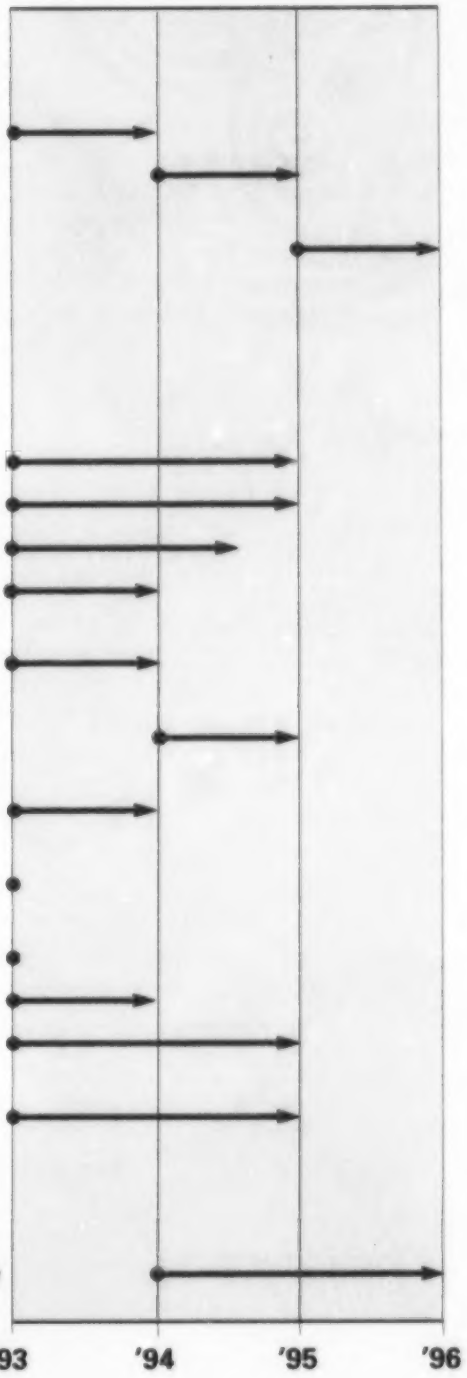
Component II

Procedural/ Legislative Changes

- Define sectors
- Identify priority pollutants
- Computerize permitting database
- Implement measures to ensure that permits are directly enforceable
- Establish legislative authority for revisiting permits
- Develop priorities and schedules for revisiting existing permits
- Implement modifications to permitting and approvals process
- Adopt National Ambient Air Quality Objectives
- Adopt national emission guidelines
- Evaluate monitoring networks
- Establish/strengthen monitoring requirements for industry
- Institute air quality index

Component III

Pilot Regional Air Quality Management Study



Appendix I

Clean Air Task Force Backgrounders

Backgrounders (available upon request from the Nova Scotia Department of the Environment):

1. Implications of Air Quality Problems for Nova Scotia
2. Types of Air Pollution Affecting Nova Scotia
3. Air Quality Monitoring in Nova Scotia
4. Nova Scotia's Contribution to the Long Range Transport of Air Pollutants
5. A Summary of Current Federal and Provincial Initiatives in the Area of Air Quality Management
6. Public Views on Air Quality and its Management
7. Air Quality Management Approaches in Selected Jurisdictions
8. Environmental Policy and Strategy Initiatives of Industry Addressing Air Quality Issues. A report prepared for the Minister's Task Force on Clean Air by R.P. Côté, Director, School for Resource and Environmental Studies, Dalhousie University with the assistance of S. Scott and N. Sutherland, School for Resource and Environmental Studies.

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Appendix II

The Members of the Minister's Task Force on Clean Air

Chairpersons

D. Wallace Clark, P.Eng., (Co-Chair), a retired electrical engineer and World War II Navy veteran, is past President and General Manager of Bowater Mersey in Liverpool, and past President and General Manager of Bowater Newfoundland. He now lives in Summerville Centre, Queens County.

Lesley Griffiths (Co-Chair) is an environmental planning consultant who specializes in public consultation, environmental impact assessment, and resource management. She has an extensive background in waste management issues, and is currently a member of the Environmental Assessment Review Panel reviewing the Halifax Harbour Clean-up project. She lives in Halifax.

Members

Billie Beattie is an air quality meteorologist with Environment Canada's Atmospheric Environment Service. Her work involves applying meteorological and chemical knowledge to pollution issues with local, regional, and global implications, such as urban pollution, pesticide drift, acid rain, elevated ground level ozone, and ozone layer depletion. She lives in Bedford.

Gerry Buchan is the Warden of the Municipality of Kings County and is President and CEO of a number of transportation and transit companies, including the Perry Rand Ltd. Transportation Group and the Zinck Bus Company. He lives in Kentville.

Dr. Owen Hertzman is an Assistant Professor of Marine Meteorology in the Atmospheric Science Program, Department of Oceanography, Dalhousie University. His primary research is on the formation and behaviour of winter storms over the ocean; he also has extensive scientific knowledge of acid precipitation, and is participating in research related to global warming. He lives in Halifax.

Wayne MacGillivary is Principal of Thornburn Consolidated School. A former Town of Pictou councillor, he has an extensive background in community activities, including chairing the deCoste Entertainment Centre and the Hector Festival and serving as Director of the Pictou County Tourism Association. He lives in Pictou.

Heather MacLeod-LaFosse, an engineering geologist, was a coal geologist with the Cape Breton Development Corporation from 1981 to 1989. She now works as a geological/geotechnical consultant with both CanMet, the coal research division of Energy, Mines and Resources Canada, and Nolan Davis & Associates. She lives in Sydney.

Jane MacNeill, P.Eng., is a chemical engineer with the Air Quality Branch of the Nova Scotia Department of the Environment. She provides technical assistance in the review and evaluation of permit applications and environmental impact assessments and recommends air pollution control and monitoring programs. Her work also involves developing and implementing regulations and guidelines for air quality protection. She lives in Timberlea.

Dr. Rosemary Marchant is a Specialist in Occupational and Environmental Health. Her training in this area includes degrees in Medicine, Toxicology, Epidemiology and two medical fellowships in Community Medicine and Occupational Medicine. Over the last twelve years, she has worked in all provinces investigating environmental and occupational health problems. Dr. Marchant was formerly an Associate Professor

of Occupational and Environmental Medicine at Dalhousie University. She now lives in St. Catharines, Ontario.

Mil Nickerson is the past President and Director of Research of the Tusket River Environmental Protection Association. A part-time commercial fisherman, Mr. Nickerson retired from the Armed Forces in 1978. He has served on a number of environmental committees and advisory bodies. He lives in Tusket River.

K. Scott Wood is the Co-ordinator of the joint Program for Continuing Environmental Education at Henson College and the School for Resource and Environmental Studies (SRES) at Dalhousie University. Prof. Wood also holds a cross-appointment at SRES. His teaching and research areas include resource and environmental accounting, environmental economics, economic geography, and community planning and development; he has worked with many community interest groups and processes related to planning, development and citizen participation, and has consulted widely with public and private agencies. He lives in Glen Margaret.

Coordination

John F. Jones, P.Eng., before his retirement from the Nova Scotia Department of the Environment in September, 1991, was Senior Policy Advisor to the Deputy Minister. Prior to that he served as Director of the Department's Water Planning and Management Division. He lives in Chester Basin.

Tim Smith is an environmental biologist and is currently completing a degree in Environmental Studies at Dalhousie University. He has worked in the environmental consulting field and has a keen interest in environmental monitoring. He lives in Herring Cove.

Appendix III

Dates and Locations of Public Meetings

Pictou	May 2, 1991
Port Hawkesbury	May 5, 1991
Sydney	May 9, 1991
Middleton	May 13, 1991
Bridgewater	May 14, 1991
Yarmouth	May 22, 1991
Halifax	June 12, 1991

Appendix IV

Contributors, Presenters, and Participants

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